You Can't Get There from Here:
Why Systems Thinking is Inseparable from Learning Organizations

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April 15, 1992

ABSTRACT
Organizational learning is intrinsically systemic, because it deals with changes in thinking and acting not only in individuals, or in teams, but organization-wide. Our ability to understand and improve organizational learning will depend on having an *operational* systems framework, which can both sharpen theoretical insights and address practical management concerns. Building on past work in organizational learning and system dynamics, the new Center for Organizational Learning at MIT is attempting to develop a rigorous foundation of systems principles and methods so that current interest in organizational learning and "learning organizations" can lead to significant advances in management theory and practice.

THE PROBLEM
Learning organizations are a contemporary management buzzword. It is widely recognized that bureaucratic, authoritarian hierarchies are incapable of the continual innovation and adaptation required in today's dynamic, unpredictable, and increasingly interconnected business environment. To prosper, even to survive, firms must "learn how to learn," and continually speed up their "learning cycle time."

But, as is so often the case with management fads, the rhetoric exceeds the reality of learning organizations. Few firms, at least in the west, recognize the depth and profundity of the changes required to become better learners. Management slogans and a few new tools cannot substitute for a long-term commitment to develop the methods, skills, attitudes, and guiding philosophy for continual organization-wide learning.

This paper focuses on one aspect of the shift from authoritarian to learning organizations, the necessity of replacing atomistic thinking with systemic thinking. Without a commitment to systemic thinking, firms lack both the tools and perspective to learn what matters in today's business world of increasing interdependence and change. Similarly, although most espouse a systems perspective, theorists are unlikely to achieve a deeper understanding of what organizational learning is all about without an operational framework that guides conceptualization and analysis.

Connecting systems thinking and organizational learning is a primary theme of the new Center for Organizational Learning developing at MIT. Working with a group of major corporations we hope to establish a partnership between researchers and practitioners to develop and test new tools that help to bring the systems perspective into the mainstream of management practice. Equally important, we hope to contribute to a variety of basic questions concerning both theory and method in the study of organizational learning and how it can be enhanced.

The paper proceeds in three steps. First, I look at how a systems perspective helps in understanding the nature of organizational learning and the barriers to achieving it. The next section considers why mangerial efforts to build learning organizations are likely to fail without a systems perspective. But, academic fields like system dynamics too must change if the synergy between learning and systems thinking is to develop -- these changes are considered briefly in the last section.

UNDERSTANDING ORGANIZATIONAL LEARNING
A systems perspective is necessary for understanding organization learning because
- organizational learning is an intrinsically "systemic," that is organization-wide, phenomenon;
- it is important to distinguish levels of learning, the more important of which have to do with changes in norms, assumptions, values, performance measures, rewards, information systems and other aspects of "systemic structure;"
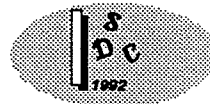
• of the multiple constraints on organization learning, among the most important are cognitive limitations in understanding complexity , which can only be identified and overcome through a rigorous systems perspective.

Organizational Learning is Intrinsically Systemic

There is widespread agreement that "organizational learning," according to Fiol and Lyles (1985), " is not simply the sum of each member's learning." "Although organizational learning occurs through individuals," writes Hedberg (1981) "it would be a mistake to conclude that organizational learning is nothing but the cumulative results of their members' learning." Yet, despite agreement among theorists, and the widespread use of terms like "organizational learning" and the "learning organization" in the business community today, there still is a tendency to think about individuals learning within organizations or about teams learning, not about organizations learning. This can be seen by recurring debates in the academic literature, as well as by confusion among managers.

Making the leap from individual to organization is not a trivial matter because it requires addressing difficult questions, such as
  " What is it that is *changing* when an organization learns ?"
  " How is knowledge developed, retained, and diffused within organizations ?"
  " What are the mediating processes that connect learning among individuals and groups with
     organization learning ?"
I believe that none of the above questions can be addressed rigorously without a well developed conceptual framework that allows us to define organizational systems of knowledge and action.

To illustrate how well-known theorists of organizational learning have grappled with these questions, consider two widely known views of organizational learning: Argyris and Schon's "theory of action" perspective and Levitt and March's perspective. Argyris and Schon's write that:
> "All human beings need to become competent in taking action and simultaneously reflecting on this action to learn from it. (We) provide a conceptual framework for this task by analyzing theories of action that determine all deliberate human behavior, how these theories are formed, how they come to change... When we attribute theories of action to human beings, we argue that all deliberate action has a cognitive basis, it reflects norms, strategies, and assumptions or models of the world ... Human learning need not be understood in terms of "reinforcement" or "extinction" of patterns of behavior but as the construction, testing, and restructuring of a certain kind of knowledge. (Argyris and Schon, 1978, p. 10)

The theory of action construct is highly individualistic. It is an attribution about the "action of human beings." To make the bridge from individual to organization, Argyris and Schon expand the concept of theory of action to look at recurring patterns of organization behavior and shared theories that they attribute lie behind those patterns. Organizational theories of action are assumed to be comprised of norms (like being a loyal member of the organization means not confronting others), shared action strategies (like protect oneself and others), recuring immediate and longer term consequences, and shared schemes for interpreting those consequences. They operationalize their approach through "maps" that group observable behavior and specific inferences into categories like governing variables, action strategies, consequences, and conclusions (eg., see Argyris 1983, Argyris, Putnam and Smith 1985). These maps are then used as tools for learning by presenting information which can be reflected upon by organization members to deepen awareness and catalyze change (Argyris 1990).

According to Argyris' and Schon's view, what is changing when an organization learns might be specific collective actions within an existing theory of action or the more general norms or governing variables which comprise the theory itself. Either way, what is changing is suppose to be "organizational" in nature.

Nonetheless, Levitt and March (1988) argue that Argyris and Schon "deal primarily with individual learning." They offer an alternative construction: "Organizations are seen as learning by encoding inferences from history into routines that guide behavior. The generic term 'routine' includes forms, rules, procedures, conventions, strategies, and technologies around which organizations are constructed and through which they operate. It also includes the structure of beliefs, frameworks, paradigms, codes, culture, and knowledge that buttress, elaborate, an condratict the formal routines." For Levitt and March

what is changing when organizations learn are the routines. They emphasize that these are beyond individuals: "routines are independent of the individual actors who execute them and are capable of surviving considerable turnover in individual actors."

Levitt and March specifically address how organizational knowledge is generated, retained and diffused. They describe diverse mechanisms of learning: trial and error experimentation, "organizational search" ("drawing from a pool of alternative routines"), and learning from the experience of other organizations (through "encoded experience in the form of technologies, codes, procedures, or similar routines"). In particular they address how organizations learn through participating in "ecologies" of interacting organizations. They discuss particular "learning traps," including difficulties of learning from experience when information representing organizational experience is extremely limited, biases in causal interpretations even when information is inadequate, and "superstitious learning," coming to believe in unfounded explanations. According to Levitt's and March's view, organizational knowledge is retained through the routines that are stored within the organization, and they consider many different diffusion dynamics. These include diffusion through stories and frames, which they consider problematic, as well as different theoretical perspectives on diffusion -- namely, epidemiology, technological innovation, and the sociology of institutionalization.

By contrast Argyris and Schon's theory of action perspective is relatively mute on how knowledge is generated, retained and diffused -- in particular, substantive knowledge about markets, products, and organizational systems and processes. But, they have more to say about the link between individual, group and organization. For Argyris and Schon, theories of action are generated by people and can be altered when people develop capabilities to reflect on their tacit norms and assumptions. The nature of these reflective abilities is spelled out in some detail in their "Model II" learning system (Argyris and Schon 1978). While Levitt and March offer a broader conception, it is difficult to operationalize. It is not clear how one would conceptualize specific learning problems in organizations or seek to influence them.

Another influential theoretical thread for our work at the Organizational Learning Center at MIT is Total Quality Management TQM. TQM is an extremely broad area of diverse tools, methods, and philosohpies but there are certain common points among many practitioners. One concerns how individual, group, and organizational learning are linked through deploying particular learning tools. These may include the traditional "seven quality tools" or the newer "seven tools for management" (Mizumo 1988). According to TQM, what is changing when an organization learns are its *processes:* "Improve constantly and forever every process for planning, production, and service," writes Deming (1982).

The perspective emerging at the Organizational Learning Center builds on the strengths of all three of these theoretical perspectives, as well as others. In particular, it is strongly influenced by the system dynamics methodology that has been developed over many years at MIT (eg., Forrester 1961, Richardson and Pugh 1981, and Wolstenholme 1990). According to the latter, what is changing when an organization learns is its "underlying feedback structure." The system dynamics concept of systemic structure incorporates much of the breadth advocated by Levitt and March and yet is more operational. It is akin to the TQM emphsis on "processes" yet it is broader in some regards and more explicitly dynamic. This notion of structure includes physical stock-flow processes and material delays, information linkages, and the "policy structure" whereby information is converted into streams of decisions. It can incorporate decision rules, operating procedures, and explicit strategies, but also the tacit norms, goals, and constraints that influence actual decisionmaking. It seeks to explain how structure shapes system-wide patterns of behavior through interacting patterns of reinforcing and balancing feedback, delays and nonlinearities. It is explicitly dynamic.

Over the past 10 years, there has been increasing attention in system dynamics on why some structures predominate over others -- why is some information considered more important than other information in making particular decisions, some goals more significant, and particular decision rules relied upon rather than others? Questions such as these have forced system dynamics model builders to consider more seriously the importance of established "mental models," in both shaping existing policies and in constraining possible changes in operating policies (eg., Morecroft 1988, Vennix 1990)

This interest in mental models reflects Argyris' and Schon's influence, as does our approach to viewing change in mental models as an essential dimension to learning, and in seeking to foster higher levels of

reflectiveness among decisionmakers. However, our approach to influencing change is more "technological" than Argyris' and Schon's, in that it focuses on developing tools and methods that allow managers to address pressing business problems in a way that surfaces tacit assumptions and ways of thinking. In this sense, our approach reflects TQM's emphasis on tools and methods. But, what we are especially interested in is helping decisionmakers discover how established ways of thinking and interacting lead to dysfunctional policies and structures, and how these dysfunctionalities are impossible for managers to discover because of those very ways of thinking and interacting -- which is quite different than traditional TQM goals.

For example, in a service company, long-term underinvestment in capacity (people, skills, training, morale, tenure and practical experience) was part of a vicious cycle of mediocre quality, low customer loyalty, high costs of poor quality, financial stress and continued underinvestment (Kim 1989, Senge and Sterman 1992). A "learning laboratory" was developed to help managers understand this vicious cycle and the assumptions and practices that kept it in operation. In the learning laboratory, managers conceptualized the interactions they perceived between quality, productivity, expenses, turnover, and total costs. Then they experimented with alternative policies for improving overall system performance, using a "management flight simulator" that incorporated the interactions they had conceptuallized. This simulator was based on a system dynamics simulation model developed in cooperation with the firm's managers. In their simulation experiments, the managers discovered that following well established practices actually led to increasing trends in total costs, and that reversing these trends required a radical shift toward long-term investment in service capacity and improved quality. What held these practices in place were established ways of defining managerial competence -- namely, keeping expenses (not total costs) in control and maintaining high levels of productivity (customers served per service personnel per month) -- and the tacit collusion of managers throughout the organization to not question these practices, or to question them passively without experimenting actively with alternatives.

To summarize, a view is gradually emerging in our work at the Organizational Learning Center that what is changing when organizational learning occurs are (1) systemic structures, (2) the mental models that lie behind those structures, (3) and ultimately the thinking and interacting skills that can allow tacit mental models to be surfaced, tested and improved. This suggests a particular sense of "organizational knowledge," and particular ways in which knowledge is developed, retained, and diffused. Specifically, knowledge is generated through reflective environments where decisionmakers can connect established mental models with manifest organizational problems. Knowledge is retained both through systemic structures and operating policies that embody that knowledge and through explicit theories of organizational dynamics captured in simulation models. These models, because they are explicit, are subject to continued testing and improvement, thereby fostering an ongoing process of increasing shared understanding of important business and organizational dynamics. Equally importantly, they are public, so they are subject to inquiry by all organization members. Knowledge is diffused through consciously designed learning processes that both help organization members understand these dynamic theories and invite them to challenge and improve the theories. This entire process continually moves between individual, team and organizational levels of learning: teams of key decisionmakers participate in these learning processes, thereby bringing their own views into the open; and new insights generated in the reflective learning laboratory setting are translated into changes in organizational structures and processes which are implemented and tested in practice.

The above view represents my personal interpretation of the views of the diverse researchers and practitioners developing the Learning Center. It is formative at this time, and I expect it to evolve as we undertake a wide range of organizational experiments in the coming years.

Levels of Learning
Many theorists distinguish between levels of learning. An operational systems framework can clarify these theoretical distinctions and help managers confronting tangible business problems distinguish the depth and significance of the learning they hope to achieve.

Perhaps the best known distinction between levels of learning is that made by Argyris and Schon, between "single loop learning" and "double loop learning:"
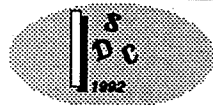
When error detection and correction permits the organization to carry on its present policies or achieve its present objectives, then that error-detection-and-corrections process is single loop learning...Double-loop learning occurs when error is detected and corrected in ways that involve the modification of an organization's underlying norms, policies, and objectives (Argyris and Schon 1978, p. 3)

Similarly, other theorists distinguish "first-order learning" from "second-order learning," or "lower-level learning" from "higher-level learning" (eg., Starbuck et.al. 1978, Shrivastava and Mitroff 1982, Nystrom and Starbuck 1984). Common to these different theorists are distinctions between behavioral adaptation without change in underlying assumptions, norms, or frames versus deeper changes in those very elements. It is assumed that higher level learning is more difficult, that it is less tangible in its outcomes, and that it often is precipitated by crisis or some other form of breakdown.

From the systemic view we are developing there is also a distinct difference between types of learning, one I have expressed in the past as between "adaptive" and "generative" learning (Senge 1990). Adaptive learning involves adjustment in decisions and actions without change in the underlying systemic structure that governs that adjustment. In adaptive learning specific behaviors change but overall patterns of system-wide behavior are unchanged. For example, during a cyclic upturn a firm may make different capital investment decisions than during a downturn, but the underlying "investment policy," which responds to trends in customer demand, is unchanged. The same operating policy produces different decisions when customer demand is rising versus when it is falling. This is a type of learning because it represents adjustment in behavior in response to environmental change so as to achieve certain overall goals (eg., maintain desired cash reserves). Adaptive learning is important because it is the sign of a healthy organization that it can adapt to changes in its environment through established routines and methods of response. Generative learning is learning that involves change in underlying structures, which is necessary to create new patterns of behavior -- such as adopting new policies which alter the character of the cycles in customer demand themselves. Generative learning is the type of learning we are most interested in because it represents the major learning challenges faced in our organizations -- in fact, the view of organizational learning articulated above focused specifically on generative learning.

This distinction between adaptive and generative learning, while simple on the surface, involves subtleties that bear explanation. First, it requires the explicit identification of a systemic structure, in order to distinguish between changes occuring within the structure from changes in the structure itself. Second, one can only speak of generative or higher-order learning relative to an explicit pattern of undesired behavior which one seeks to change. Third, while generative learning may involve changes in underlying assumptions, norms, and frames -- and, in my experience, almost always does -- it may also manifest in changes in information flows, how work is organized, and the operating goals, measures and rewards which operationalize organizational values. So, in this sense, generative learning is a broader construct than double loop learning, even though the two have much in common. Lastly, generative learning seems often to hinge on people coming to a new grasp of the systemic consequences of their actions, a condition that is implied by other theorists but has not been developed in the literature.

To illustrate, let's return to the service firm described above caught in the vicious cycle of underinvestment, poor quality, and financial stress. Imagine that we have developed an explicit systemic model of these interacting forces,which includes key decisions being made by the managers within that structure -- such as hiring, setting production targets, managing quality. Given the overall pattern of increasing financial pressure, decisionmakers are learning how to cut back hiring, get more customers served with fewer people, and to cope with stress so as to minimize turnover. These are all forms of adaptive learning -- or more accurately in this case, mal-adaptive learning because the better managers become in this areas, the more they may contribute to the vicious cycle. What needs to change is the overall structure of policies, measures, and rewards that make up the structure. This will require double-loop learning in the Argyris and Schon sense because it will require managers to recognize the norms (eg., managerial competence means controlling expenses) and assumptions (eg., increasing customers served per employee is the key to success) that justify current policies. Still deeper, it may involve overcoming general managers' desires to control hiring decisions and everyone's desire to avoid potentially divisive conversations about how our own managerial practices might be causing our problems.

But, breaking through these norms may also require people understanding how the vicious cycle works, that is understanding how managerial practices which are succesful in the short term in controling expenses have unintended side effects, like poor quality and low customer loyalty, which worsen financial conditions in the long run. Moreover, our experience is that this "understanding," as Kim says, cannot be simply "conceptual" but must also be "emotional" **(Kim 1992)**. In other words, people need to experience directly the longer term side effects of their actions in a way that has an impact on their sense of competence and confidence. This can be painful, but, in the right setting, it can also be humorous and cathartic. And, most importantly it can unfreeze established mental models and lead to willingness to experiment with new ways of making decisions. The failure of managers to grasp the systemic consequences of their decisions, as much as their adherence to norms like staying in control and avoiding embarrassment, may be what thwarts deeper learning.

Constraints on Learning
Theorists have identified a variety of institutional, political, and behavioral constraints on organizational learning. The systems perspective has proven especially powerful at understanding cognitive constraints on learning. Going back to Simon (1957), there is a rich literature on "bounded rationality" and the consequent limitations of human decisionmakers to form valid inferences about complex causal interrelations that influence the outcomes of their actions. "Connections between actions and outcomes," according to Levitt and March (1988) "are (often) misspecified" by decision-makers who also tend to "overattribute events to the intentional actions of individuals, ... associate causality with spatial and temporal contiguity, ... (and make) systematic baises in interpretation."

Experimental studies have begun to make more precise attributions about cognitive constraints. In particular, experiments have shown that decisionmakers' performance starts to erode when they have to contend with more than one feedback process, and when they encounter lengthy delays or nonlinearities between action and consequence. For example, in a simulated production distribution system, many decisionmakers take inadequate account of the delay between when orders are placed and when shipments are received in making their ordering decision. This leads to overordering and fluctuations throughout the system. (Sterman 1989). Moreover, they overlook altogether the nonlinear response of suppliers' lead times to their own orders: if they overorder only slightly, lead times are unaffected; if they overorder more severely, suppliers' stocks are wiped out, lead times increase, which in turn causes still more ordering and worsens lead times still further. Diehl (1992) has shown that performance decays as time delays lengthen and as reinforcing (positive) feedbacks get stronger. Paich and Sterman (1992) have shown that decisionmakers' performance does not improve significantly with repeated experiences. And, Kampmann and Sterman (1992) have shown that groups of decisionmakers interacting in a market structure, even in perfectly functioning markets, perform significantly poorer than optimal.

Such studies are helping us to understand in quite specific terms recurring problems in understanding and acting effectively in complex systems. These insights not only help in understanding why organizational learning often breaks down but also in designing learning processes that can overcome limits to learning. The ability to gain this understanding depends on the ability to construct carefully specified experiments based on dynamic models that represent generic organizational systems.

BUILDING LEARNING ORGANIZATIONS
While many managers are intent on accelerating organizational learning, few appreciate the connections between systems thinking and learning. Consequently, their efforts are unlikely to result in deep insights and systemic changes. "Learning organizations" will likely go the way of other management fads, the subject of much talk and activity, signifying little of substance.

Systems Thinking and Shared Vision
The Japanese approach to knowledge generation, according to Nonaka (1991), hinges on "personal commitment, the employees sense of identity with the enterprise and with its mission." Hamel and Prahalad (1989) have taken western corporations approach to strategy, and the Business schools and consulting firms which have propagated that approach, to task for failing to develop bol "strategic intents" that can lift people's sights and galvanize diverse interests around a daring pursuit. Ackoff (1974) calls for inventing a "desired end state" and then planning backward how to get there.
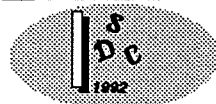
But, the reasons why many firms fail to foster a shared sense of mission and shared visions may lie as much with how the organization's members view current reality as with the clarity of their future vision. How can a shared view of future possibilities flourish against a background of fragmented views of current reality? Aligning a diverse organization around a shared vision requires lifting people out of their normal fragmented views and local concerns.

The connection betwen systems thinking and shared vision also touches on the confidence needed to believe that a desired vision is realizable. The psychological basis for vision in an organization lies in people's belief that they can influence their destiny. Yet, most people in organizations have a view of reality that their problems "were created by somebody else." This is the central attitudinal task of systems thinking -- helping people to see how their own actions influence their reality, through seeing the long term and systemic consequences of their actions. In this way systems thinking provides the necessary soil for the seed of vision to flourish.

Systems Thinking and Leverage

The concept of leverage, central to systems thinking, holds that most of the interventions attempted by managers address changes that are unlikely to have significant enduring consequences. People focus on assumed causes that are close in time and space to obvious symptoms. Yet, in complex systems "cause and effect are usually distant in time and space." This leads to expending large amounts of effort and resources on trying to bring about changes that are not likely to have much lasting impact.

Areas of high leverage only become evident when one understands the dynamics of a system as a whole. This is a primary objective for constructing system dynamics simulation models.

Systems Thinking and Process Improvement Methods

Recognizing the need for practical tools to operationalize a commitment to accelerate organizational learning, many managers are advocating total quality process analysis and improvement tools. While such tools are important, they fall well short of what is needed..

First, a broader perspective than process improvement is needed to make wise choices in focusing process improvement efforts. As one auto executive lamented, "If we spent all the time improving the processes that people identify for improvement, we'd never have time to build an automobile." Obviously, what matters is to improve the most critical processes. But, how are people to identify the most critical -- ie., high leverage -- processes? Answering this question requires a broader perspective that shows how different processes interact.

Second, a systems perspective can protect against "suboptimization," making improvements in particular areas that actually make matters worse in other areas. For example, improving the process whereby central staff experts are allocated to help local managers with personnel problems may actually be detrimental in the long run, if it shifts the burden away from developing skills in dealing with personnel issues among local managers. Another form of suboptimization occurs when different local improvement efforts interact adversely.

Lastly, without practical systems learning tools, middle managers and especially senior managers are often left out of the learning process. This is seen repeatedly in TQM efforts. When such efforts are successful they engage local managers, supervisors, and front line workers in analysis of and improvement in work processes. But even in those organizations with significant ongoing process improvement efforts, rarely is the work of senior management affected. Senior managers typically become cheerleaders and supporters. Rarely, are they called upon to make significant changes in how they do their work.

The reason is that the work of management is more concerned with the systemic interactions between basic processes, the organization's overall direction, and how the organization interacts with its environment . These are systemic and dynamic issues. They require surfacing mental models and challenging established assumptions. Different tools are required to support such work than the standard process improvement methods.

Designing Learning Processes

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Lastly, management's capacity to design learning processes that get at major organization issues is limited without systems thinking tools. As illustrated in the preceeding section, we believe the most powerful such learning processes will incorporate explicit tools designed to capture current assumptions and engage organizational members at all levels in understanding and challenging those assumptions. One such set of tools is system dynamics conceptualization methods and simulation models. There are other system conceptualization tools (eg., Checkland 1981), although most are less explicitly dynamic. Another set of tools which have proven useful is the scenario planning approach developed at Shell (Wack 1985), which focuses on thinking through alternative patterns of behavior without trying to model the causes of those behavior patterns. Regardless of what tools are used, what matters is that they aid in surfacing, challenging, and retaining mental models. Not only is this vital for a particular learning process, but it makes possible the comparison of future behavior with past assumptions to support ongoing learning.

EVOLUTION OF SYSTEMS THINKING TO MEET THE CHALLENGE
Appreciating the need for an operational systems perspective to underpin organizational learning would be of little use if there were no tools to implement that perspective. Fortunately, system dynamics, as well as the broader systems thinking field, has evolved in the past ten years in many ways so as to be better prepared to meet the challenge of organizational learning. In system dynamics, new computer hardware and software developments have made model building and model utilization vastly more accessible (Richmond 1990). There has been a new emphasis on developing generic management learning tools that can are being widely disseminated (Graham et. al. 1989) and there is ongoing research to study and improve learning processes such as the learning laboratory (Vennix 1990, Senge 1992).

What is also needed is shared understanding of how these particular developments fit within a broader overall pattern. Checkland (1985) has described the evolution of systems thinking in management from "hard systems thinking" to "soft systems thinking." For Checkland, the"hard systems" thinkers of the 1950's and 1960's held an overarching conception of human systems as goal seeking and sought to help in "optimizing" those systems. Eventually, the objective of optimization was abandoned as inappropriate. "Simon (1960) pointed out," says Checkland, "that the abstraction from reality necessary to facilitate mathematical manipulation of operations resreach models runs the danger of convincing the analyst that the simplified problem was the problem he wanted to solve all along."

Nevertheless, Simon and most other systems proponents of this era, Checkland argues, still held to the view of "goal seeking as the model of human behavior." In Simon's (1960) words, "Problem solving proceeds by erecting goals, detecting differences between present situation and goal, finding in memory or by search tools or processes that are relevant to reducing differences... and applying these tools or processes." More importantly, the implicit belief was that the goals were unambiguous: "Heuristic programing, as in Simon's General Problem Solver," notes Checkland "has so far concentrated on the solution of trivial problems for which goal statements are unambiguous."

Checkland contrasts "hard systems thinking" with the more recent "soft systems" approach, an exemplar of which he sees in Geoffrey Vickers work. Vickers was, in Checkland's words, interested in "governance: the exercise of judgement, the weighing of moral issues, the creation of form. This mental activity he regarded as common to statesmen, judges, artists, doctors, and business executives." Vickers framed his work as the development of "appreciation," and sought to foster "appreciative systems," which he saw as fundamentally different from goal seeking systems. Vickers rejected the idea that the description of a system has no effect on the system itself: although the actual structure of the solar system is unaffected by belief in either Ptolomeic or Copernican cosmology, Marx's theory of economic affairs had a first order impact on the reality he was describing. In human systems, observer and observed interact. Similary, he believed that when the people in a human system reflect on the system it can alter their goals, so system goals are themselves part of the dynamics of "appreciation," not independent drivers of change as the "hard systems thinkers" would have it.

Rather than being goal seeking Vickers saw the underlying purpose in human systems as building and maintaining relationships. "To get the job," Vickers (1970) says," or marry the girl is indifferently an end, a means and a goal: it is an opportunity for a new relationship. But the object of the exercise is to do the job and live with the girl: to sustain through time a relationship which needs no further justification but is, or is expected to be satisfying in itself."

Vickers' view of appreciation implies a particular way of thinking about systems tools for learning as opposed to problem solving. Checkland's framework, which he calls "soft systems methodology," proposes an ongoing cycle of inquiry and experimentation that "moves from finding out about a problem situation to taking action in the situation." Conceptual models are used to focus dialogue and debate about the problem situation, especially by "comparing models with perceptions of the real world." The aim of the conversation is to seek possible courses of action that are "systemically desireable and culturally feasible." Formulating and taking such actions leads eventually to a new cycle of conceptualization and inquiry. In this approach, models are rhetorical devices as much as "representations of reality." Their validity or usefulness must be assessed over time by the quality of the conversation they foster, and the clarity and effectiveness of the actions they precipitate. This is the essence of "modeling as learning" as opposed to "modeling as problem solving," a view many of us in system dynamics are considering more and more seriously (David C. Lane, "Modeling as Learning").

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