THE FIFTH DISCIPLINE

THE ART AND PRACTICE OF THE LEARNING ORGANIZATION

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DOES YOUR ORGANIZATION HAVE A LEARNING DISABILITY?

Few large corporations live even half as long as a person. In 1983, a Royal Dutch/Shell survey found that one third of the firms in the Fortune "500" in 1970 had vanished.1 Shell estimated that the average lifetime of the largest industrial enterprises is less than forty years, roughly half the lifetime of a human being! The chances are fifty-fifty that readers of this book will see their present firm disappear during their working career.

In most companies that fail, there is abundant evidence in advance that the firm is in trouble. This evidence goes unheeded, however, even when individual managers are aware of it. The organization as a whole cannot recognize impending threats, understand the implications of those threats, or come up with alternatives.

Perhaps under the laws of "survival of the fittest," this continual death of firms is fine for society. Painful though it may be for the employees and owners, it is simply a turnover of the economic soil, redistributing the resources of production to new companies and new cultures. But what if the high corporate mortality rate is only a symptom of deeper problems that afflict all companies, not just the ones that die? What if even the most successful companies are poor learners—they survive but never live up to their potential? What if, in light of what organizations could be, "excellence" is actually "mediocrity"?

It is no accident that most organizations learn poorly. The way they are designed and managed, the way people's jobs are defined, and, most importantly, the way we have all been taught to think and interact (not only in organizations but more broadly) create fundamental learning disabilities. These disabilities operate despite the best efforts of bright, committed people. Often the harder they try to solve problems, the worse the results. What learning does occur takes place despite these learning disabilities—for they pervade all organizations to some degree.

Learning disabilities are tragic in children, especially when they go undetected. They are no less tragic in organizations, where they also go largely undetected. The first step in curing them is to begin to identify the seven learning disabilities:

1. "I AM MY POSITION"

We are trained to be loyal to our jobs—so much so that we confuse them with our own identities. When a large American steel company began closing plants in the early 1980s, it offered to train the displaced steelworkers for new jobs. But the training never "took"; the workers drifted into unemployment and odd jobs instead. Psychologists

came in to find out why, and found the steelworkers suffering from acute identity crises. "How could I do anything else?" asked the workers. "I am a lathe operator."

When asked what they do for a living, most people describe the tasks they perform every day, not the purpose of the greater enterprise in which they take part. Most see themselves within a "system" over which they have little or no influence. They "do their job," put in their time, and try to cope with the forces outside of their control. Consequently, they tend to see their responsibilities as limited to the boundaries of their position.

Recently, managers from a Detroit auto maker told me of stripping down a Japanese import to understand why the Japanese were able to achieve extraordinary precision and reliability at lower cost on a particular assembly process. They found the same standard type of bolt used three times on the engine block. Each time it mounted a different type of component. On the American car, the same assembly required three different bolts, which required three different wrenches and three different inventories of bolts—making the car much slower and more costly to assemble. Why did the Americans use three separate bolts? Because the design organization in Detroit had three groups of engineers, each responsible for "their component only." The Japanese had one designer responsible for the entire engine mounting, and probably much more. The irony is that each of the three groups of American engineers considered their work successful because their bolt and assembly worked just fine.

When people in organizations focus only on their position, they have little sense of responsibility for the results produced when all positions interact. Moreover, when results are disappointing, it can be very difficult to know why. All you can do is assume that "someone screwed up."

2. "THE ENEMY IS OUT THERE"

A friend once told the story of a boy he coached in Little League, who after dropping three fly balls in right field, threw down his glove and marched into the dugout. "No one can catch a ball in that darn field," he said.

There is in each of us a propensity to find someone or something outside ourselves to blame when things go wrong. Some organizations elevate this propensity to a commandment: "Thou shall always find an external agent to blame." Marketing blames manufacturing: "The reason we keep missing sales targets is that our quality is not competitive." Manufacturing blames engineering. Engineering blames marketing: "If they'd only quit screwing up our designs and let us design the products we are capable of, we'd be an industry leader."

The "enemy is out there" syndrome is actually a by-product of "I am my position," and the nonsystemic ways of looking at the world that it fosters. When we focus only on our position, we do not see how our own actions extend beyond the boundary of that position. When those actions have consequences that come back to hurt us, we misperceive these new problems as externally caused. Like the person being chased by his own shadow, we cannot seem to shake them.

The "Enemy Is Out There" syndrome is not limited to assigning blame within the organization. During its last years of operation, the once highly successful People Express Airlines slashed prices, boosted marketing, and bought Frontier Airlines—all in a frantic attempt to fight back against the perceived cause of its demise: increasingly aggressive competitors. Yet, none of these moves arrested the company's mounting losses or corrected its core problem, service quality that had declined so far that low fares were its only remaining pull on customers.

For many American companies, "the enemy" has become Japanese competition, labor unions, government regulators, or customers who "betrayed us" by buying products from someone else. "The enemy is out there," however, is almost always an incomplete story. "Out there" and "in here" are usually part of a single system. This learning

disability makes it almost impossible to detect the leverage which we can use "in here" on problems that straddle the boundary between us and "out there."

3. THE ILLUSION OF TAKING CHARGE

Being "proactive" is in vogue. Managers frequently proclaim the need for taking charge in facing difficult problems. What is typically meant by this is that we should face up to difficult issues, stop waiting for someone else to do something, and solve problems before they grow into crises. In particular, being proactive is frequently seen as an antidote to being "reactive"—waiting until a situation gets out of hand before taking a step. But is taking aggressive action against an external enemy really synonymous with being proactive?

Not too long ago, a management team in a leading property and liability insurance company with whom we were working got bitten by the proactiveness bug. The head of the team, a talented vice president for claims, was about to give a speech proclaiming that the company wasn't going to get pushed around anymore by lawyers litigating more and more claims settlements. The firm would beef up its own legal staff so that it could take more cases through to trial by verdict, instead of settling them out of court.

Then we and some members of the team began to look more sys-temically at the probable effects of the idea: the likely fraction of cases that might be won in court, the likely size of cases lost, the monthly direct and overhead costs regardless of who won or lost, and how long cases would probably stay in litigation. (The tool we used is discussed in Chapter 17, "Microworlds.") Interestingly, the team's scenarios pointed to increasing total costs because, given the quality of investigation done initially on most claims, the firm simply could not win enough of its cases to offset the costs of increased litigation. The vice president tore up his speech.

All too often, "proactiveness" is reactiveness in disguise. If we simply become more aggressive fighting the "enemy out there," we are reacting—regardless of what we call it. True proactiveness comes from seeing how we contribute to our own problems. It is a product of our way of thinking, not our emotional state.

4. THE FIXATION ON EVENTS

Two children get into a scrap on the playground and you come over to untangle them. Lucy says, "I hit him because he took my ball." Tommy says, "I took her ball because she won't let me play with her airplane." Lucy says, "He can't play with my airplane because he broke the propeller." Wise adults that we are, we say, "Now, now, children—just get along with each other." But are we really any different in the way we explain the entanglements we find ourselves caught in? We are conditioned to see life as a series of events, and for every event, we think there is one obvious cause.

Conversations in organizations are dominated by concern with events: last month's sales, the new budget cuts, last quarter's earnings, who just got promoted or fired, the new product our competitors just announced, the delay that just was announced in our new product, and so on. The media reinforces an emphasis on short-term events—after all, if it's more than two days' old it's no longer "news." Focusing on events leads to "event" explanations: "The Dow Jones average dropped sixteen points today," announces the newspaper, "because low fourth-quarter profits were announced yesterday." Such explanations may be true as far as they go, but they distract us from seeing the longer-term patterns of change that lie behind the events and from understanding the causes of those patterns.

Our fixation on events is actually part of our evolutionary programming. If you wanted to design a cave person for survival, ability to contemplate the cosmos would not be a high-ranking design criterion. What is important is the ability to see the saber-toothed tiger over your left shoulder and react quickly. The irony is that, today, the primary threats to our survival, both of our organizations and of our societies, come not from sudden events but from slow, gradual processes; the arms race, environmental

decay, the erosion of a society's public education system, increasingly obsolete physical capital, and decline in design or product quality (at least relative to competitors' quality) are all slow, gradual processes.

Generative learning cannot be sustained in an organization if people's thinking is dominated by short-term events. If we focus on events, the best we can ever do is predict an event before it happens so that we can react optimally. But we cannot learn to create.

5. THE PARABLE OF THE BOILED FROG

Maladaptation to gradually building threats to survival is so pervasive in systems studies of corporate failure that it has given rise to the parable of the "boiled frog." If you place a frog in a pot of boiling water, it will immediately try to scramble out. But if you place the frog in room temperature water, and don't scare him, he'll stay put. Now, if the pot sits on a heat source, and if you gradually turn up the temperature, something very interesting happens. As the temperature rises from 70 to 80 degrees F., the frog will do nothing. In fact, he will show every sign of enjoying himself. As the temperature gradually increases, the frog will become groggier and groggier, until he is unable to climb out of the pot. Though there is nothing restraining him, the frog will sit there and boil. Why? Because the frog's internal apparatus for sensing threats to survival is geared to sudden changes in his environment, not to slow, gradual changes.

Something similar happened to the American automobile industry. In the 1960s, it dominated North American production. That began to change very gradually. Certainly, Detroit's Big Three did not see Japan as a threat to their survival in 1962, when the Japanese share of the U.S. market was below 4 percent. Nor in 1967, when it was less than 10 percent. Nor in 1974, when it was under 15 percent. By the time the Big Three began to look critically at its own practices and core assumptions, it was the early 1980s, and the Japanese share of the American market had risen to 21.3 percent. By 1989, the Japanese share was approaching 30 percent, and the American auto industry could account for only about 60 percent of the cars sold in the U.S.2 It is still not clear whether this particular frog will have the strength to pull itself out of the hot water.

Learning to see slow, gradual processes requires slowing down our frenetic pace and paying attention to the subtle as well as the dramatic. If you sit and look into a tidepool, initially you won't see much of anything going on. However, if you watch long enough, after about ten minutes the tidepool will suddenly come to life. The world of beautiful creatures is always there, but moving a bit too slowly to be seen at first. The problem is our minds are so locked in one frequency, it's as if we can only see at 78 rpm; we can't see anything at 33 1/3. We will not avoid the fate of the frog until we learn to slow down and see the gradual processes that often pose the greatest threats.

6. THE DELUSION OF LEARNING FROM EXPERIENCE

The most powerful learning comes from direct experience. Indeed, we learn eating, crawling, walking, and communicating through direct trial and error—through taking an action and seeing the consequences of that action; then taking a new and different action. But what happens when we can no longer observe the consequences of our actions? What happens if the primary consequences of our actions are in the distant future or in a distant part of the larger system within which we operate? We each have a "learning horizon," a breadth of vision in time and space within which we assess our effectiveness. When our actions have consequences beyond our learning horizon, it becomes impossible to learn from direct experience.

Herein lies the core learning dilemma that confronts organizations: we learn best from experience but we never directly experience the consequences of many of our most important decisions. The most critical decisions made in organizations have systemwide consequences that stretch over years or decades. Decisions in R&D have first-order consequences in marketing and manufacturing. Investing in new

manufacturing facilities and processes influences quality and delivery reliability for a decade or more. Promoting the right people into leadership positions shapes strategy and organizational climate for years. These are exactly the types of decisions where there is the least opportunity for trial and error learning.

Cycles are particularly hard to see, and thus learn from, if they last longer than a year or two. As systems-thinking writer Draper Kauffman, Jr., points out, most people have short memories. "When a temporary oversupply of workers develops in a particular field," he wrote, "everyone talks about the big surplus and young people are steered away from the field. Within a few years, this creates a shortage, jobs go begging, and young people are frantically urged into the field—which creates a surplus. Obviously, the best time to start training for a job is when people have been talking about a surplus for several years and few others are entering it. That way, you finish your training just as the shortage develops."3

Traditionally, organizations attempt to surmount the difficulty of coping with the breadth of impact from decisions by breaking themselves up into components. They institute functional hierarchies that are easier for people to "get their hands around." But, functional divisions grow into fiefdoms, and what was once a convenient division of labor mutates into the "stovepipes" that all but cut off contact between functions. The result: analysis of the most important problems in a company, the complex issues that cross functional lines, becomes a perilous or nonexistent exercise.

7. THE MYTH OF THE MANAGEMENT TEAM

Standing forward to do battle with these dilemmas and disabilities is "the management team," the collection of savvy, experienced managers who represent the organization's different functions and areas of expertise. Together, they are supposed to sort out the complex cross-functional issues that are critical to the organization. What confidence do we have, really, that typical management teams can surmount these learning disabilities?

All too often, teams in business tend to spend their time fighting for turf, avoiding anything that will make them look bad personally, and pretending that everyone is behind the team's collective strategy —maintaining the appearance of a cohesive team. To keep up the image, they seek to squelch disagreement; people with serious reservations avoid stating them publicly, and joint decisions are watered-down compromises reflecting what everyone can live with, or else reflecting one person's view foisted on the group. If there is disagreement, it's usually expressed in a manner that lays blame, polarizes opinion, and fails to reveal the underlying differences in assumptions and experience in a way that the team as a whole could learn.

"Most management teams break down under pressure," writes Harvard's Chris Argyris—a longtime student of learning in management teams. "The team may function quite well with routine issues. But when they confront complex issues that may be embarrassing or threatening, the 'teamness' seems to go to pot."4

Argyris argues that most managers find collective inquiry inherently threatening. School trains us never to admit that we do not know the answer, and most corporations reinforce that lesson by rewarding the people who excel in advocating their views, not inquiring into complex issues. (When was the last time someone was rewarded in your organization for raising difficult questions about the company's current policies rather than solving urgent problems?) Even if we feel uncertain or ignorant, we learn to protect ourselves from the pain of appearing uncertain or ignorant. That very process blocks out any new understandings which might threaten us. The consequence is what Argyris calls "skilled incompetence"—teams full of people who are incredibly proficient at keeping themselves from learning.

DISABILITIES AND DISCIPLINES

These learning disabilities have been with us for a long time. In The March of Folly, Barbara Tuchman traces the history of devastating large-scale policies "pursued contrary to ultimate self-interest,"5 from the fall of the Trojans through the U.S. involvement in Vietnam. In story after story, leaders could not see the consequences of their own policies, even when they were warned in advance that their own survival was at stake. Reading between the lines of Tuchman's writing, you can see that the fourteenth-century Valois mon-archs of France suffered from "I am my position" disabilities— when they devalued currency, they literally didn't realize they were driving the new French middle class toward insurrection.

In the mid-1700s Britain had a bad case of boiled frog. The British went through "a full decade," wrote Tuchman, "of mounting conflict with the [American] colonies without any [British official] sending a representative, much less a minister, across the Atlantic . . . to find out what was endangering the relationship . . ."[6] By 1776, the start of the American Revolution, the relationship was irrevocably endangered. Elsewhere, Tuchman describes the Roman Catholic cardinals of the fifteenth and sixteenth centuries, a tragic management "team" in which piety demanded that they present an appearance of agreement. However, behind-the-scenes backstabbing (in some cases, literal backstabbing) brought in opportunistic popes whose abuses of office provoked the Protestant Reformation.

We live in no less perilous times today, and the same learning disabilities persist, along with their consequences. The five disciplines of the learning organization can, I believe, act as antidotes to these learning disabilities. But first, we must see the disabilities more clearly—for they are often lost amid the bluster of day-to-day events.

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PRISONERS OF THE SYSTEM, OR PRISONERS OF OUR OWN THINKING?

In order to see the learning disabilities in action, it helps to start with a laboratory experiment—a microcosm of how real organizations function, where you can see the consequences of your decisions play out more clearly than is possible in real organizations. For this reason, we often invite people to take part in a simulation called the "beer game," first developed in the 1960s at the Massachusetts Institute of Technology's Sloan School of Management. Because it is a "laboratory replica" of a real setting, rather than reality itself, we can isolate the disabilities and their causes more sharply than is possible in real organizations. This reveals that the problems originate in basic ways of thinking and interacting, more than in peculiarities of organization structure and policy.

The beer game does this by immersing us in a type of organization which is rarely noticed but widely prevalent: a production/distribution system, the kind responsible for producing and shipping consumer and commercial goods in all industrial countries. In this case, it's a system for producing and distributing a single brand of beer. The players at each position are completely free to make any decision that seems prudent. Their only goal is to manage their position as best they can to maximize their profits.[1]

As with many games, the "playing" of a single session of the beer game can be told as a story. There are three main characters in the story—a retailer, a wholesaler, and the marketing director of a brewery.[2] This story is told, in turn, through each of the players' eyes.

THE RETAILER

Imagine that you're a retail merchant. Perhaps you're the franchise manager of a brightly lit twenty-four-hour chain store at a suburban intersection. Or maybe you own a mom-and-pop grocery on a street of Victorian-era brownstones. Or a discount beverage outlet on a remote highway.

No matter what your store looks like, or whatever else you sell, beer is a cornerstone of your business. Not only do you make a profit on it, but it draws customers in to buy, perhaps, popcorn and potato chips. You stock at least a dozen different brands of beer, and keep a rough tally of how many cases of each are in your back room, which is where you keep your inventory.

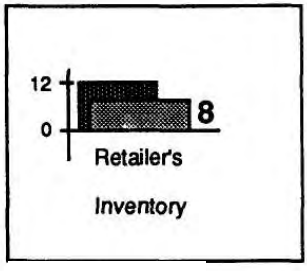
Once each week, a trucker arrives at the rear entrance of your store. You hand him a form on which you've filled in that week's order. How many cases of each brand do you want delivered? The trucker, after he makes his other rounds, returns your order to your beer wholesaler, who then processes it, arranges outgoing orders in a proper sequence, and ships the resulting order to your store. Because of all that processing, you're used to a four-week delay on average on your orders; in other words, a delivery of beer generally arrives in your store about four weeks after you order it.

You and your beer wholesaler never speak to each other directly. You communicate only through those check marks on a piece of paper. You probably have never even met him; you know only the truck driver. And that's for good reason: you have hundreds of products in your store. Dozens of wholesalers dole them out to you. Meanwhile, your beer wholesaler handles deliveries to several hundred stores, in a dozen different cities. Between your steady deluge of customers and his order-shuffling, who has time for chitchat? That single number is the only thing you need to say to each other.

One of your steadiest beer brands is called Lover's Beer. You are dimly aware that it's made by a small but efficient brewery located about three hundred miles away from you. It's not a super-popular brand; in fact, the brewery doesn't advertise at all. But every week, as regularly as your morning newspaper deliveries, four cases of Lover's Beer sell from the shelves. Sure, the customers are young— most are in their twenties—and fickle; but somehow, for every one who graduates to Miller or Bud, there's a younger sister or brother to replace him.

To make sure you always have enough Lover's Beer, you try to keep twelve cases in the store at any time. That means ordering four cases each Monday, when the beer truck comes. Week after week after week. By now, you take that four-case turnover for granted; it's inextricably wedded to the image in your mind of the beer's performance. You don't even articulate it to yourself when placing the order: "Oh, yeah," runs the automatic litany. "Lover's Beer. Four cases."

Week 2: Without warning, one week in October (let's call it Week 2), sales of the beer



Week 2

double. They jump from four cases to eight. That's all right, you figure; you have an eight-case surplus in your store. You don't know why they've sold so much more suddenly. Maybe someone is having a party. But to replace those extra cases, you raise your order to eight. That will bring your inventory back to normal.

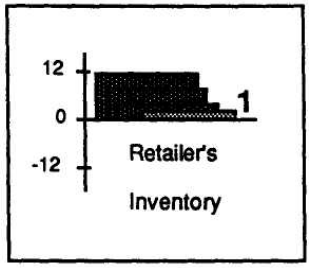
Week 3: Strangely enough, you also sell eight cases of Lover's Beer the *next* week. And it's not even spring break. Every once in a while, in those rare moments between sales, you briefly ponder the reason why. There's no advertising campaign for the beer; you would have received a mailing about it. Unless the mailing got lost, or you accidentally threw it out. Or maybe there's another reason . . . but a customer comes in, and you lose your train of thought.

At the moment the deliveryman comes, you're still not thinking much about Lover's Beer, but you look down at your sheet and see that he's brought only four cases this time. (It's from the order you placed four weeks ago.) You only have four cases left in stock, which means—unless there's a drop-back in sales—you're going to sell out all your Lover's Beer this week. Prudence dictates an order of at least eight cases to keep up with sales. Just to be on the safe side, you order twelve so you can rebuild your inventory.

Week 4: You find time on Tuesday to quiz one or two of your younger customers. It turns out that a new music video appeared a month or so back on the popular cable television channels. The video's recording group, the Iconoclasts, closes their song with the line, "I take one last sip of Lover's Beer and run into the sun." You don't know why they used that line, but

your wholesaler would have told you if there was any new merchandising deal. You think of calling the wholesaler, but a delivery of potato chips arrives and the subject of Lover's Beer slips your mind.

When your next delivery of beer comes in, only five cases of beer arrive. You're chagrined now because you have only one case in stock. You're almost sold out. And thanks to this video,



Week 4

demand might go up *even further*. Still, you know that you have some extra cases on order, but you're not sure exactly how many. Better order at least sixteen more.

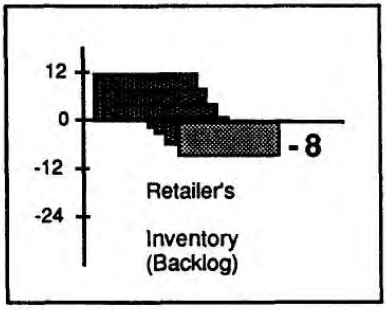
Week 5: Your one case sells out Monday morning. Fortunately, you receive a shipment for seven more cases of Lover's (apparently your wholesaler is starting to respond to your higher orders). But all are sold by the end of the week, leaving you with absolutely zero inventory. Glumly, you stare at the empty shelf. Better order another sixteen. You don't want to get a reputation for being out of stock of popular beers.

Week 6: Sure enough, customers start coming in at the beginning of the week, looking for Lover's. Two are loyal enough to wait for your backlog. "Let us know as soon as it comes in," they say, "and we'll be back to buy it." You note their names and phone numbers: they've promised to buy one case each.

Only six cases arrive in the next shipment. You call your two "backlogged" customers. They stop in and buy their shares; and the rest of the beer sells out before the end of the week. Again, two customers give you their names to call as soon as your next shipment arrives. You wonder how many more you could have sold had your shelves not been empty at the end of the week. Seems there's been a run on the beer: none of the stores in the area have it. This beer is hot, and it's apparently getting more popular all the time.

After two days of staring at the parched, empty shelf, it doesn't feel right to order any less than another sixteen cases. You're tempted to order more, but you restrain yourself because you know the big orders you've been placing will start to arrive soon. But when . . . ?

Week 7: The delivery truck brings only five cases this week, which means that you're facing another week of empty shelves. As soon as you fill your back orders, Lover's Beer is sold out again, this time within two days. This week, amazingly, five customers give you their names. You order another sixteen and silently pray that your big orders will start arriving. You think of all the lost potato chip sales.



Week 8

Week 8: By now, you're watching Lover's Beer more closely than any other product you sell. The suspense is palpable: every time a customer buys a six-pack of that quiet beer, you notice it. People seem to be talking about the beer. Eagerly, you wait for the trucker to roll in the sixteen cases you expect.

But he brings only five. "What do you mean, five?" you say. "Gee, I don't know anything about it," the deliveryman tells you. "I guess they're backlogged. You'll get them in a couple of weeks." A couple of *weeks!?!* By the time you call your backlogged customers, you'll be sold out before you can sell a single new case. You'll be without a bottle of Lover's on your shelf all week. What will this do to your reputation?

You place an order for twenty-four more cases—twice as much as you had planned to order. What is that wholesaler *doing* to me, you wonder? Doesn't he know what a ravenous market we have down here? What's going through his mind, anyway?

THE WHOLESALER

As the manager of a wholesale distributing firm, beer is your life. You spend your days at a steel desk in a small warehouse stacked high with beer of every conceivable brand: Miller, Bud, Coors, Rolling Rock, a passel of imported beers—and, of course, regional beers such as Lover's Beer. The region you serve includes one large city, several smaller satellite cities, a web of suburbs, and some outlying rural areas. You're not the only beer wholesaler here, but you're very well established. For several small brands, including Lover's Beer, you are the only distributor in this area.

Mostly, you communicate with the brewery through the same method which retailers use to reach you. You scribble numbers onto a form which you hand your driver each week. Four weeks later, on average, the beer arrives to fill that order. Instead of ordering by the case, however, you order by the gross. Each gross is about enough to fill a small truck, so you think of them as truckloads. Just as your typical retailer orders about four cases of Lover's Beer from you, week after week after week, so you order four truckloads from the brewery, week after week after week. That's enough to give you a typical accumulation of twelve truckloads' worth in inventory at any given time.

By Week 8, you had become almost as frustrated and angry as your retailers. Lover's Beer had always been a reliably steady brand. But a few weeks ago—in Week 4, actually—those orders had abruptly started rising sharply. The next week, orders from retailers had risen still further. By Week 8, most stores were ordering three or four times their regular amount of beer.

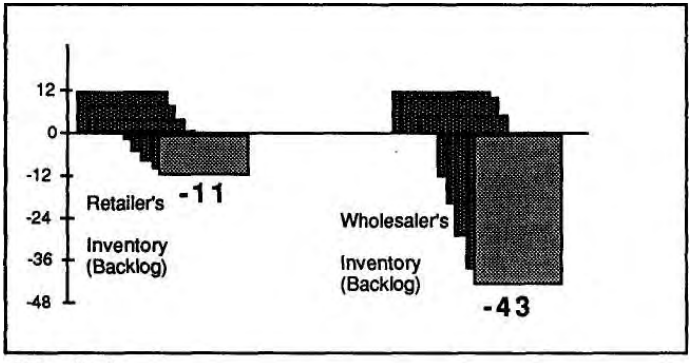
At first, you had easily filled the extra orders from your inventory in the warehouse. And you had been prescient; noting that there was a trend, you had immediately raised the amount of Lover's Beer you ordered from the brewery. In Week 6, after seeing an article in *Beer Distribution News* about the rock video, you had raised your brewery order still further, to a dramatic twenty truckloads per week. That was five times as much

beer as your regular order. But you had needed that much; the beer's popularity was doubling, tripling, and even quadrupling, to judge from the stores' demand.

By Week 6, you had shipped out all the beer you had in inventory and entered the hellishness of backlog. Each week you sent out what you could, and sent the stores paperwork equivalents of I.O.U.s to cover the rest. A few of the larger chain stores called you and got what preferential treatment you could offer, but the Lover's Beer in your inventory was gone. At least you knew it would be only a couple of weeks more before the extra beer you ordered would begin to arrive.

In Week 8, when you had called the brewery to ask if there was any way to speed up their deliveries (and to let them know that you were upping your order to thirty truckloads), you were dismayed to find out that they had only just stepped up production two weeks before. They were just learning of the increase in demand. How could they be so slow?

Now it's Week 9. You're getting orders for twenty truckloads'



Week 9

worth of Lover's Beer per week, and you still don't have *it*. By the end of last week, you had backlogged orders of another twenty-nine truckloads. Your staff is so used to fielding calls that they've asked you to install an answering machine devoted to an explanation about Lover's Beer. But you're confident that, this week, the twenty truck-loads you ordered a month ago will finally arrive.

However, only six truckloads arrive. Apparently the brewery is still backlogged, and the larger production runs are only now starting to get shipped out. You call some of your larger chains and assure them that the beer they ordered will be coming shortly.

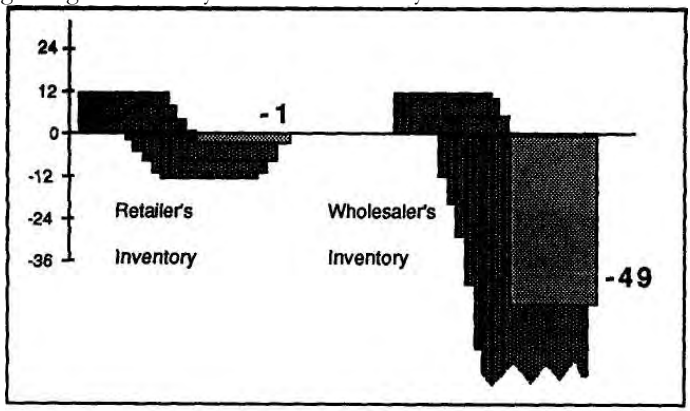
Week 10 is infuriating. The extra beer you were expecting—at least twenty truckloads' worth—doesn't show. The brewery simply couldn't ramp up production that fast. Or so you guess. They only send you eight truckloads. It's impossible to reach anybody on the phone down there—they're apparently all on the factory floor, manning the brewery apparatus.

The stores, meanwhile, are apparently selling the beer wildly. You're getting unprecedented orders—for twenty-six truckloads this week. Or maybe they're ordering so much because *they* can't get any of the beer from you. Either way, you'have *to* keep up. What if you can't get any of the beer and they go to one of your competitors?

You order forty truckloads from the brewery.

In Week 11, you find yourself tempted to take extra-long lunches at the bar around the corner from your warehouse. Only *twelve* truckloads of Lover's Beer arrive. You still can't reach anybody at the brewery. And you have over *a hundred* truckloads' worth of orders to fill: seventy-seven truckloads in backlog, and another twenty-eight truckloads' worth of orders from the stores which you receive this week. Some of those backlog costs come due, and you're afraid to tell your accountant what you expect.

You've got to get that beer: you order *another* forty truckloads from the brewery.



Week 14

By Week 12, it's clear. This new demand for Lover's Beer is a far more major change than you expected. You sigh with resignation when you think of how much money you could make if you only had enough in stock. How could the brewery have *done* this to you? Why did demand have to rise so *quickly?* How are you ever expected to keep up? All you know is that you're never going to get caught in this situation again. You order sixty more truckloads.

For the next four weeks, the demand continues to outstrip your supply. In fact, you can't reduce your backlog at all in Week 13.

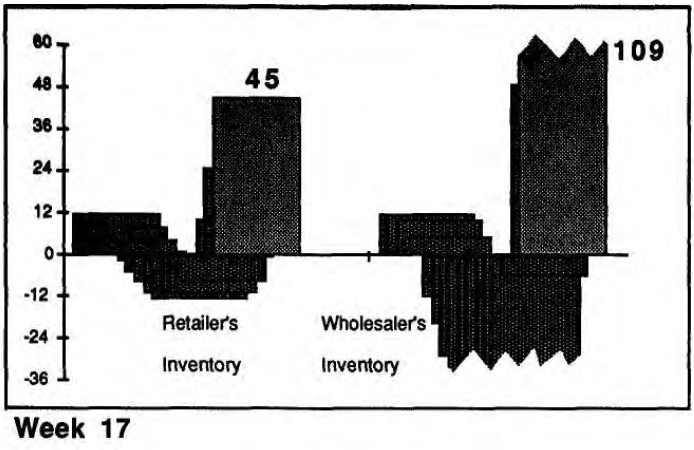
You finally start receiving larger shipments from the brewery in Weeks 14 and 15. At the same time, orders from your stores drop off a bit. Maybe in the previous weeks, you figure, they overordered a bit. At this point, anything that helps work off your backlog is a welcome reprieve.

And now, in Week 16, you finally get almost *all* the beer you asked for weeks ago: fifty-five truckloads. It arrives early in the week, and you stroll back to that section of the warehouse to take a look at it, stacked on pallets. It's as much beer as you keep for any major brand. And it will be moving out soon.

Throughout the week, you wait expectantly for the stores' orders to roll in. You even stop by the intake desk to see the individual forms. But on form after form, you see the same number written: zero. Zero. Zero. Zero. Zero. What's wrong with these people? Four weeks ago, they were screaming at you for the beer, now, they don't even want any.

Suddenly, you feel a chill. Just as your trucker leaves for the run that includes the brewery, you catch up with him. You initial the form, and cross out the twenty-four truckloads you had ordered, replacing it with a zero of your own.

Week 17: The next week, sixty more truckloads of Lover's Beer arrive. The stores still ask for—zero. You still ask for—zero. One hundred and nine truckloads of the stuff sit in your warehouse. You could bathe in the stuff every day, and it wouldn't make a dent.



Surely the stores will want more *this* week. After all, that video is still running. In your brooding thoughts, you consign every retailer to the deepest corner of hell; the corner reserved for people who don't keep their promises.

And, in fact, the retailers once again order zero cases of Lover's Beer from you. You, in turn, order zero truckloads from the brewery. And yet, the brewery continues to deliver beer. Sixty more truckloads appear on your dock this week. Why does that brewery have it in for you? When will it ever end?

THE BREWERY

Imagine that you were hired four months ago to manage distribution and marketing at the brewery, where Lover's Beer is only one of several primary products. Yours is a small brewery, known for its quality, not its marketing savvy. That's why you were hired.

Now, clearly, you have been doing something right. Because in only your second month (Week Six of this game), new orders had begun to rise dramatically. By the end of your third month on the job, you felt the satisfaction of getting orders for forty gross worth of beer per *week,* up dramatically from the four when you started. And you shipped out . . . well, you shipped out thirty.

Because breweries get backlogs too. It takes (in your brewery, at least) two weeks from the time you decide to brew a bottle of beer until the moment when that beer is ready for shipment. Admittedly, you kept a few weeks' worth of beer in your warehouse, but those stocks were exhausted by Week 7, only two weeks after the .rising orders came in. The next week, while you had back orders for nine gross and another twenty-four gross in new orders, you could send out only twenty-two gross. By that time you were a hero within your company. The plant manager had given everyone incentives to work double-time, and was feverishly interviewing for new factory help.

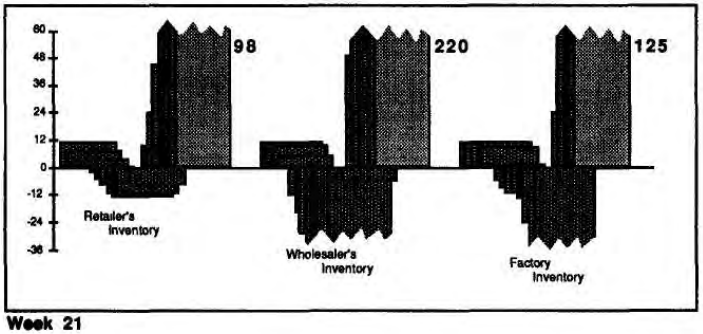
You had lucked out with that Iconoclasts' video mentioning the beer. You had learned about the video in Week 3—from letters written by teenagers to the brewery. But it had taken until Week 6 to see that video translate into higher orders.

Even by Week 14, the factory had *still* not caught up with its backlogged orders. You had regularly requested brew batches of seventy gross or more. You had wondered how large your bonus would be that year. Maybe you could ask for a percentage of the profits, at least once you caught up with back orders. You had even idly pictured yourself on the cover of *Marketing Week.*

Finally, you *had* caught up with the backlog in Week 16. But the next week, your distributors had asked for only nineteen gross. And last week, Week 18, they had not

asked for any more beer at all. Some of the order slips actually had orders crossed out on them.

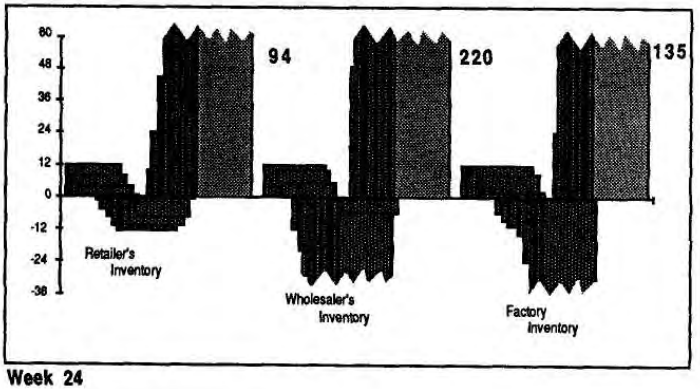
Now, it's Week 19. You have a hundred gross of beer in inventory. And the orders, once again, ask for virtually no new deliveries. Zero beer. Meanwhile the beer you've been brewing keeps rolling in. You place the phone call you've dreaded making to your boss. "Better hold off on production for a week or two," you say. "We've got"—



Week 21

and you use a word you've picked up in business school—"a discontinuity." There is silence on the other end of the phone. "But I'm sure it's only temporary," you say.

The same pattern continues for four more weeks: Weeks 20, 21, 22, and 23. Gradually your hopes of a resurgence slide, and your excuses come to sound flimsier and flimsier. Those distributors screwed us, you say. The retailers didn't buy enough beer. The press and that rock video hyped up the beer and got everybody sick of it. At root, it's the fickle kids—they have no loyalty whatsoever. How could they buy hundreds of cases one month, and nothing at all the next?



Week 24

Nobody misses you when you borrow the company car at the beginning of Week 24. Your first stop is the wholesaler's office. Not only is it the first time you have ever met face to face, but it is only the second time you have ever spoken. There has never been anything to say until this crisis. You greet each other glumly, and then the wholesaler takes you out to the back warehouse. "We haven't gotten an order for your brand in two months," says the wholesaler. "I feel completely jerked around. Look! We still have 220 truckloads here."

What must have happened, you decide together, is that demand rose rapidly, and then fell dramatically. Another example of the fickleness of the public. If the retailers had stayed on top of it and warned you, this would never have happened.

You are working over the phrasing of a marketing strategy report in your mind on the way home when, on a whim, you decide to stop at the store of a retailer you pass along the way. Fortuitously, the owner of the store is in. You introduce yourself and the retailer's face breaks into a sardonic grin. Leaving an assistant in charge of the shop, the two of you walk next door to a luncheonette for a cup of coffee.

The retailer has brought along the shop's inventory tally notebooks, and spreads them open across the table. "You don't know how much I wanted to strangle you a few months ago."

"Why?" you ask.

"Look—we're stuck with ninety-three cases in our back room. At this rate, it's going to be another six weeks before we order any more."

Six weeks, you think to yourself. And then you pull out a pocket calculator. If *every* retailer in this area waits six weeks before ordering any more beer, and then only orders a few cases a week, it's going to be a year or more before they put a dent in those 220 truckloads sitting at the wholesaler's. "This is a tragedy," you say.

"Who let it happen—I mean, how can we keep it from happening again?"

"Well, it's not *our* fault," says the retailer, after sipping some coffee. "We were selling four cases of beer when that music video came out. Then, in Week 2, we sold eight cases."

"And then it mushroomed," you say. "But then why did it die down?"

"No, you don't understand," says the retailer. "The demand never mushroomed. And it never died out. We *still* sell eight cases of beer—week after week after week. But *you* didn't send us the beer we wanted. So we had to keep ordering, just to make sure we had enough to keep up with our customers."

"But we got the beer out as soon as it was necessary."

"Then maybe the wholesaler screwed up somehow," says the retailer. "I've been wondering if I should switch suppliers. Anyway, I wish you'd do a coupon promotion or something, so I could make back some of my costs. I'd like to unload some of those ninety-three cases."

You pick up the tab for coffee. Then, on your trip back, you plan the wording of your resignation notice. Obviously, you'll be blamed for any layoffs or plant closings that come out of this crisis—just as the wholesaler blamed the retailer, and the retailer blamed the wholesaler, and both of them wanted to blame you. At least it's early enough in the process that you can quit with some dignity. If only you could come up with some explanation to show that it wasn't your fault—to show that you were the victim, instead of the culprit.

LESSONS OF THE BEER GAME

1. *Structure Influences Behavior*

Different people in the same structure tend to produce qualitatively similar results. When there are problems, or performance fails to live up to what is intended, it is easy to find someone or something to blame. *But, more often than we realize, systems cause their own crises, not external forces or individuals' mistakes.*

2. *Structure in Human Systems is Subtle*

We tend to think of "structure" as external constraints on the individual. But, *structure* in complex living systems, such as the "structure" of the multiple "systems" in a human body (for example, the cardiovascular and neuromuscular) *means the basic interrelationships that control behavior.* In human systems, structure

includes how people make decisions—the "operating policies" whereby we translate perceptions, goals, rules, and norms into actions.

3. *Leverage Often Comes from New Ways of Thinking*
In human systems, people often have potential leverage that they do not exercise because they focus only on their own decisions and ignore how their decisions affect others. In the beer game, players have it in their power to eliminate the extreme instabilities that invariably occur, but they fail to do so because they do not understand how they are creating the instability in the first place.

People in the business world love heroes. We lavish praise and promotion on those who achieve visible results. But if something goes wrong, we feel intuitively that somebody must have screwed up. In the beer game, there are no such culprits. There is no one to blame. Each of the three players in our story had the best possible intentions: to serve his customers well, to keep the product moving smoothly through the system, and to avoid penalties. Each participant made well-motivated, clearly defensible judgments based on reasonable guesses about what might happen. There were no villains, but there was a crisis nonetheless—built into the structure of the system.

In the last twenty years, the beer game has been played thousands of times in classes and management training seminars. It has been played on five continents, among people of all ages, nationalities, cultural origins, and vastly varied business backgrounds. Some players had never heard of a production/distribution system before; others had spent a good portion of their lives working in such businesses. Yet every time the game is played the same crises ensue. First, there is growing demand that can't be met. Orders build throughout the system. Inventories are depleted. Backlogs grow. Then the beer arrives en masse while incoming orders suddenly decline. By the end of the experiment, almost all players are sitting with large inventories they cannot unload—for example, it is not unusual to find brewery inventory levels in the hundreds overhanging orders from wholesalers for eight, ten, or twelve cases per week.[3]

If literally thousands of players, from enormously diverse backgrounds, all generate the same qualitative behavior patterns, the causes of the behavior must lie beyond the individuals. The causes of the behavior must lie in the structure of the game itself.

Moreover "beer game"-type structures create similar crises in real-life production-distribution systems. For instance, in 1985, personal computer memory chips were cheap and readily available; sales went down by 18 percent and American producers suffered 25 to 60 percent losses.[4] But in late 1986 a sudden shortage developed and was then exacerbated by panic and overordering. The result was a 100 to 300 percent increase in prices for the same chips.[5] A similar surge and collapse in demand occurred in the semiconductor industry in 1973 to 1975. After a huge order buildup and increases in delivery delays throughout the industry, demand collapsed and you could have virtually any product you wanted off any supplier's shelf overnight. Within a few years, Siemens, Signetics, Northern Telecom, Honeywell, and Schlumberger all entered the business by buying weakened semiconductor manufacturers.[6]

In mid-1989, General Motors, Ford, and Chrysler, as the May 30 Wall Street Journal put it, "were simply producing far more cars than they were selling, and dealer inventories were piling up ... The companies already are idling plants and laying off workers at rates not seen for years."[7] Entire national economies undergo the same sorts of surges in demand and inventory overadjustments, due to what economists call the "inventory accelerator" theory of business cycles.

Similar boom and bust cycles continue to recur in diverse service businesses. For example, real estate is notoriously cyclic, often fueled by speculators who drive up

prices to attract investors to new projects. "The phone would ring," Massachusetts condominium developer Paul Quinn told the *"MacNeil-Lehrer Newshour"* in 1989, "in our offices, and we said 'How are we going to handle this? We'll tell everybody to send in a $5,000 check with their name and we'll put them on the list.' The next thing we knew, we had over 150 checks sitting on the desk." The glut followed quickly on the boom: "It was a slow, sinking feeling," Quinn said, interviewed in a seaside town full of unsold developments. "Now's the time to start building for the next boom. Unfortunately, the people in the real estate industry are too busy trying to address the problems they have left over from the last one."[8]

In fact, reality in production-distribution systems is often worse than the beer game. A real retailer can order from three or four wholesalers at once, wait for the first group of deliveries to arrive, and cancel the other orders. Real producers often run up against production capacity limits not present in the game, thereby exacerbating panic throughout the distribution system. In turn, producers invest in additional capacity because they believe that current demand levels will continue into the future, then find themselves strapped with excess capacity once demand collapses.

The dynamics of production-distribution systems such as the beer game illustrate the first principle of systems thinking:

STRUCTURE INFLUENCES BEHAVIOR

When placed in the same system, people, however different, tend to produce similar results.

The systems perspective tells us that we must look beyond individual mistakes or bad luck to understand important problems. We must look beyond personalities and events. We must look into the underlying structures which shape individual actions and create the conditions where types of events become likely. As Donella Meadows expresses it:

> A truly profound and different insight is the way you begin to see that the system causes its own behavior.[9]

This same sentiment was expressed over a hundred years ago by a systems thinker of an earlier vintage. Two thirds of the way through *War and Peace,* Leo Tolstoy breaks off from his narrative about the history of Napoleon and czarist Russia to contemplate why historians, in general, are unable to explain very much:

The first fifteen years of the nineteenth century present the spectacle of an extraordinary movement of millions of men. Men leave their habitual pursuits; rush from one side of Europe to the other; plunder, slaughter one another, triumph and despair; and the whole current of life is transformed and presents a quickened activity, first moving at a growing speed, and then slowly slackening again. What was the cause of that activity, or from what laws did it arise? asked the human intellect.

The historians, in reply to that inquiry, lay before us the sayings and doings of some dozens of men in one of the buildings in the city of Paris, summing up those doings and sayings by one word —revolution. Then they give us a detailed biography of Napoleon, and of certain persons favorably or hostilely disposed to him; talk of the influence of some of these persons upon others; and then say that this it is to which the activity is due; and these are its laws.

But, the human intellect not only refuses to believe in that explanation, but flatly declares that the method of explanation is not a correct one . . . The sum of men's individual wills produced both the revolution and Napoleon; and only the sum of those wills endured them and then destroyed them.

"But whenever there have been wars, there have been great military leaders; whenever there have been revolutions in states, there have been great men," says history. "Whenever there have been great military leaders there have, indeed, been wars," replies the human reason; "but that does not prove that the generals were the cause of the wars,

and that the factors leading to warfare can be found in the personal activity of one man.[10] Tolstoy argues that only in trying to understand underlying "laws of history," his own synonym for what we now call systemic structures, lies any hope for deeper understanding:

For the investigation of the laws of history, we must completely change the subject of observations, must let kings and ministers and generals alone, and study the homogeneous, infinitesimal elements by which the masses are led. No one can say how far it has been given to man to advance in that direction in understanding the laws of history. But it is obvious that only in that direction lies any possibility of discovering historical laws; and that the human intellect has hitherto not devoted to that method of research one millionth part of the energy that historians have put into the description of the doings of various kings, ministers, and generals . . ."

The term "structure," as used here, does not mean the "logical structure" of a carefully developed argument or the reporting "structure" as shown by an organization chart. Rather, "systemic structure" is concerned with the key interrelationships that influence behavior over time. These are not interrelationships between people, but among key variables, such as population, natural resources, and food production in a developing country; or engineers' product ideas and technical and managerial know-how in a high-tech company.

In the beer game, the structure that caused wild swings in orders and inventories involved the multiple-stage supply chain and the delays intervening between different stages, the limited information available at each stage in the system, and the goals, costs, perceptions, and fears that influenced individuals' orders for beer. But it is very important to understand that when we use the term "systemic structure" we do not just mean structure outside the individual. The nature of structure in human systems is subtle because *we* are part of the structure. This means that we often have the power to alter structures within which we are operating.

However, more often than not, we do not perceive that power. In fact, we usually don't see the structures at play much at all. Rather, *we just find ourselves feeling compelled to act in certain ways.*

In 1973, psychologist Philip Zimbardo performed an experiment in which college students were placed in the roles of prisoners and guards in a mock prison set up in the basement of the psychology building at Stanford. What started as mild resistance by the "prisoners" and assertiveness by the "guards," steadily escalated into increasing rebelliousness and abusiveness, until the "guards" began to physically abuse the "prisoners" and the experimenters felt the situation was dangerously out of control. The experiment was ended prematurely, after six days, when students began to suffer from depression, uncontrollable crying, and psychosomatic illnesses.[12]

I'll never forget one particularly chilling illustration of the power of structure in international politics. It occurred in a private meeting with a high-ranking member of the Soviet embassy, a few months after the Soviets had sent troops into Afghanistan. The official talked, eloquently and with great sincerity, about how the U.S.S.R. had been the first to recognize the country after its founding. The U.S.S.R. had been the first to come to its aid, repeatedly, when there was internal strife or instability. Beginning in the late 1970s, as threats from guerrilla factions increased, the ruling government asked for increasing Soviet assistance. Modest assistance led to greater needs for broader help. It came to a point, the official explained, where "We really had no choice but to intervene militarily."

As I listened to this tale, I couldn't help but think of how retailers or wholesalers in the beer game will explain, when the game is over, that they really had no choice but to keep increasing their orders. It also brought to mind similar stories of American officials, ten or fifteen years earlier, trying to explain how the United States became entangled in Vietnam.

What, exactly, does it mean to say that structures generate particular patterns of behavior? How can such controlling structures be recognized? How would such knowledge help us to be more successful in a complex system?

The beer game provides a laboratory for exploring how structure influences behavior. Each player—retailer, wholesaler, and brewery —made only one decision per week: how much beer to order. The retailer is the first to boost orders significantly, with orders peaking around Week 12. At that point, the expected beer fails to arrive on time—because of backlogs at the wholesale and brewery levels. But the retailer, not thinking of those backlogs, dramatically increased orders to get beer at any cost. That sudden jump in orders is then amplified through the whole system—first by the wholesaler, and then by the brewery. Wholesaler orders peak at about 40, and brewery production peaks at about 80.

The result is a characteristic pattern of buildup and decline in orders at each position, amplified in intensity as you move "up-stream," from retailers to breweries. In other words, the further from the ultimate consumer, the higher the orders, and the more dramatic the collapse. In fact, virtually all brewery players go through major crises, ending with near-zero production rates only weeks after having produced 40, 60, 100 or more gross per week.[13]

The other characteristic pattern of behavior in the game can be seen in the inventories and backlogs. The retailer's inventory begins to drop below zero at around Week 5. The retailer's backlog continues to increase for several weeks and the retailer doesn't get back to a positive inventory until around Weeks 12 to 15. Similarly, the wholesaler is in backlog from around Week 7 through around Weeks 15 to 18, and the brewery from Week 9 through Weeks 18 to 20. Once inventories begin to accumulate, they reach large values (about 40 for the retailer, 80 to 120 for the wholesaler, and 60 to 80 for the brewery by Week 30)—much larger than intended. So each position goes through an inventory-backlog cycle: first there is insufficient inventory, then there is too much inventory.

These characterisic patterns of overshoot and collapse in ordering and inventory-backlog cycles occur *despite stable consumer demand.* The actual consumer orders experienced only one change. In Week 2, consumer orders doubled—going from four cases of beer per week to eight. They remained at eight cases per week for the rest of the game.

In other words, after a one-time increase, consumer demand, for the rest of the simulation, was perfectly flat! Of course, none of the players other than the retailer knew consumer demand, and even the retailers saw demand only week by week, with no clue about what would come next.

After the beer game, we ask the people who played wholesalers and brewers to draw what they think the consumer orders were. Most draw a curve which rises and falls, just as their orders rose and fell.14 In other words, the players assume that if orders in the game rose and collapsed, this must have been due to a surge and collapse in consumer orders. Such assumptions of an "external cause" are characteristic of nonsystemic thinking.

Players' guesses regarding consumer demand shed light on our deeply felt need to find someone or something to blame when there are problems. Initially, after the game is over, many believe that the culprits are the players in the other positions. This belief is shattered by seeing that the same problems arise in all plays of the game, regardless of who is manning the different positions. Many then direct their search for a scapegoat toward the consumer. "There must have been a wild buildup and collapse in consumer demand," they reason. But when their guesses are compared with the flat customer orders, this theory too is shot down.

This has a devastating impact on some players. I'll never forget the president of a large trucking firm sitting back, wide-eyed, staring at the beer game charts. At the next break, he ran to the telephones. "What happened?" I asked when he returned.

"Just before we came here," he said, "my top management team had concluded a three-day review of operations. One of our divisions had tremendously unstable fluctuations in fleet usage. It seemed pretty obvious that the division president didn't have what it took to get the job done. We automatically blamed the man, just as each of us in the experiment automatically blamed the brewery. It just hit me that the problems were probably structural, not personal. I just dashed out to call our corporate headquarters and cancel his termination process."

Once they see that they can no longer blame one another, or the customer, the players have one last recourse—*blame the system.* "It's an unmanageable system," some say. "The problem is that we couldn't communicate with each other." Yet this too turns out to be an untenable position. In fact, given the "physical system" of inventories, shipping delays, and limited information, there is substantial room for improving most team's scores.

REDEFINING YOUR SCOPE OF INFLUENCE: HOW TO IMPROVE PERFORMANCE IN THE BEER GAME

To begin to see the possibilities for improvement, consider the outcomes if each player did nothing to correct his inventory or backlog. Following the "no strategy" strategy, each player would simply place new orders equal to orders he received. This is about the simplest ordering policy possible. If you receive new incoming orders for four cases of beer, you place orders for four. If you receive incoming orders for eight, you place orders for eight. Given the pattern of consumer demand in this game, that means ordering four cases or truckloads every week—until you receive your first order of eight. Thereafter you order eight.

When this strategy is followed unswervingly by all three players, all three positions settle into a form of stability by Week 11. The retailer and wholesaler never quite catch up with their backlogs. Backlogs develop, as in the basic game, due to the delays in getting orders filled. Backlogs persist because the players make no effort to correct them—because the "no strategy" strategy precludes placing the orders in excess of orders received needed to correct backlogs.

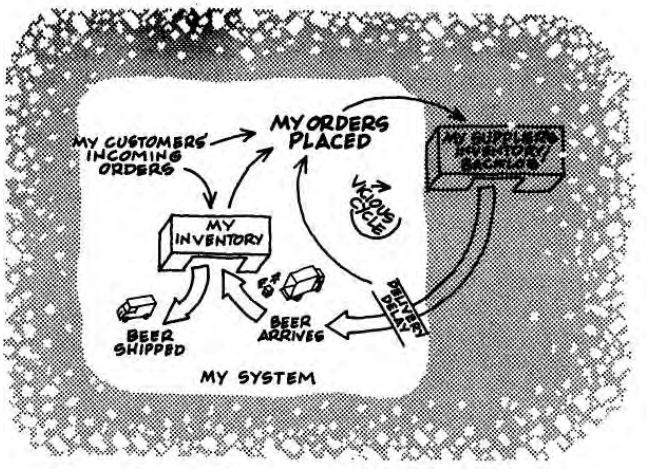
Is the "no strategy" strategy successful? Probably, most players would say no. After all, the strategy generates persistent backlogs. This means that everyone throughout the system is kept waiting longer than necessary for his orders to be filled. In real life, such a situation would, undoubtedly, invite competitors to enter a market and provide better delivery service. Only producers/distributors with monopolies on markets would be likely to stick to such a strategy.[15]

But the strategy eliminates the buildup and collapse in ordering, and the associated wild swings in inventories. Moreover, total cost generated by all positions in the "no strategy" strategy is lower than what is achieved by 75 percent of the teams that play the game![16] In other words, the majority of players in the game, many of them experienced managers, do much worse than if they simply placed orders equal to the orders they receive. In trying to correct the imbalances that result from "doing nothing," most players make matters worse, in many cases dramatically worse.

On the other hand, about 25 percent of the players score better than the "no strategy" strategy, and about 10 percent score very much better. In other words, success is possible. But it requires a shift of view for most players. It means getting to the heart of fundamental mismatches between common ways of thinking about the game—what we will later call our "mental model" of it—and the actual reality of how the game works. Most players see their job as "managing their position" in isolation from the rest of the system. What is required is to see how their position interacts with the larger system.

Consider how you feel if you are a typical player at any position. You pay close attention to your own inventory, costs, backlog, orders, and shipments. Incoming orders come from "outside"—most wholesalers and brewers, for instance, are shocked by the

implacable mystery of those latter-half orders, which *should* be high numbers, but instead appear week after week as "zero, zero, zero, zero." You respond to new orders by shipping out beer, but you have little sense of how those shipments will influence the next round of orders. Likewise, you have only a fuzzy concept of what happens to the orders you place; you simply expect them to show up as new shipments after a reasonable delay. Your perspective of the system looks something like this:

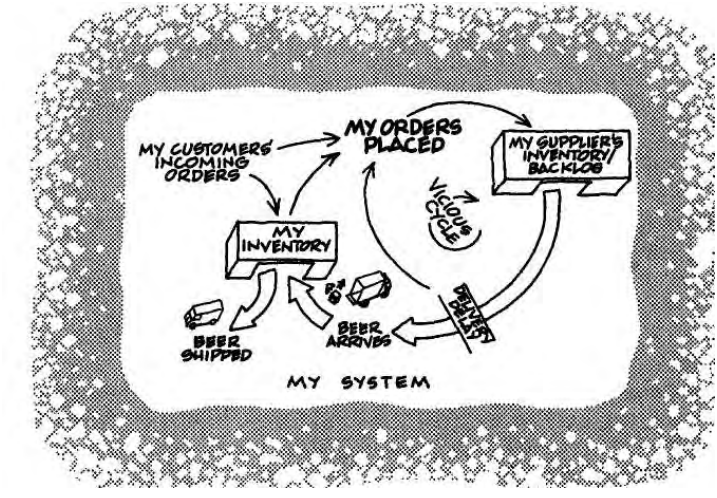


Given this picture of the situation, if you need beer it makes sense to place more orders. If your beer doesn't arrive when expected, you place still more orders. Given this picture of the situation, your job is to "manage your position," reacting to changes in the "external imputs" of incoming orders, beer arrivals, and your supplier's delivery delay.

What the typical "manage your position" view misses is the ways that your orders interact with others' orders to influence the variables you perceive as "external." The players are part of a larger system that most perceive only dimly. For example, if they place a large number of orders, they can wipe out their supplier's inventory, thereby causing their supplier's delivery delay to increase. If they, then, respond (as many do) by placing still more orders, they create a "vicious cycle" that increases problems throughout the system.

This vicious cycle can be set off by any player who panics, anywhere within the system—be he retailer, or wholesaler. Even factories can create the same effect, simply by failing to produce enough beer. Eventually, as one vicious circle influences other vicious circles, the resulting panic spreads up and down the entire production-distribution system. Once the panic builds momentum, I have seen players generate orders that are twenty to fifty times what is actually needed to correct real inventory imbalances.

To improve performance in the beer game players must redefine their scope of influence. As a player in any position, your influence is broader than simply the limits of your own position. You don't simply place orders which go off into the ether and return as beer supplies; those orders influence your supplier's behavior. Which in turn might influence yet another supplier's behavior. In turn, your success is not just influenced by your orders; it is influenced by the actions of everyone else in the system. For example, if the brewery runs out of beer, then pretty soon, everyone else will run out of beer. Either the larger system works, or your position will not work. *Interestingly, in the beer game and in many other systems, in order for you to succeed others must succeed as well.* Moreover, each player must share this systems viewpoint—for, if any single player panics and places a large order, panics tend to reinforce throughout the system.



There are two key guidelines for players in the game.

First, keep in mind the beer that you have ordered but which, because of the delay, has not yet arrived. I call this the "Take two aspirin and wait" rule. If you have a headache and need to take aspirin, you don't keep taking aspirin every five minutes until your headache goes away. You wait patiently for the aspirin to take effect because you know that aspirin operates with a delay. Many players keep ordering beer every week until their inventory discrepancy goes away.

Second, don't panic. When your supplier can't get you the beer you want as quickly as normal, the worst thing you can do is order more beer. Yet, that is exactly what many players do. It takes discipline to contain the overwhelming urge to order more when backlogs are building and your customers are screaming. But, without that discipline, you and everyone else will suffer.

These guidelines are consistently missed by most players because they are evident only if you understand the interactions that cross the boundaries between different positions. The "take two aspirin and wait" guideline comes from understanding the delay embedded in the response of your supplier's shipments to changes in your orders placed. The "don't panic" guideline comes from understanding the vicious cycle created when your orders placed exacerbate your supplier's delivery delay.

How well can players do if they follow these guidelines?

It is not possible to totally eliminate all overshoots in orders and all inventory/backlog cycles. It is possible to hold these instabilities to a very modest level, a small fraction of what occurred in Lover's Beer. It is possible to achieve total costs that are one fifth of the "do nothing" strategy, or about one tenth the typical costs achieved by teams. In other words, substantial improvements are possible.

THE LEARNING DISABILITIES AND OUR WAYS OF THINKING

All of the learning disabilities described in Chapter 2 operate in the beer game:

- Because they "become their position," people do not see how their actions affect the other positions.
- Consequently, when problems arise, they quickly blame each other—"the enemy" becomes the players at the other positions, or even the customers.
- When they get "proactive" and place more orders, they make matters worse.

- Because their overordering builds up gradually, they don't realize the direness of their situation until it's too late.
- By and large, they don't learn from their experience because the most important consequences of their actions occur elsewhere in the system, eventually coming back to create the very problems they blame on others.[17]
- The "teams" running the different positions (usually there are two or three individuals at each position) become consumed with blaming the other players for their problems, precluding any opportunity to learn from each others' experience.[18]

The deepest insights in the beer game come from seeing how these learning disabilities are related to alternative ways of thinking in complex situations. For most, the overall experience of playing the game is deeply dissatisfying because it is purely reactive. Yet, most eventually realize that the source of the reactiveness lies in their own focus on week-by-week events. Most of the players in the game get overwhelmed by the shortages of inventory, surges in incoming orders, disappointing arrivals of new beer. When asked to explain their decisions, they give classic "event explanations." I ordered forty at Week 11 because my retailers ordered thirty-six and wiped out my inventory." So long as they persist in focusing on events, they are doomed to reactiveness.

The systems perspective shows that there are multiple levels of explanation in any complex situation, as suggested by the diagram below. In some sense, all are equally "true." But their usefulness is quite different. Event explanations—"who did what to whom"— doom their holders to a reactive stance. As discussed earlier, event explanations are the most common in contemporary culture, and that is exactly why reactive management prevails.

Systemic Structure (generative)

Patterns of Behavior (responsive)

Events (reactive)

Pattern of behavior explanations focus on seeing longer-term trends and assessing their implications. For example, in the beer game, a pattern of behavior explanation would be: "Production/distribution systems are inherently prone to cycles and instability, which become more severe the further you move from the retailer. Therefore, sooner or later, severe crises are likely at the brewery." Pattern of behavior explanations begin to break the grip of short-term reactiveness. At least they suggest how, over a longer term, we can *respond* to shifting trends.[19]

The third level of explanation, the "structural" explanation, is the least common and most powerful. It focuses on answering the question, "What causes the patterns of behavior?" In the beer game, a structural explanation must show how orders placed, shipments, and inventory interact to generate the observed patterns of instability and amplification; taking into account the effects of built-in delays in filling new orders, and the vicious cycle that arises when rising delivery delays lead to more orders placed. Though rare, structural explanations, when they are clear and widely understood, have considerable impact.

An exceptional example of a leader providing such insight was Franklin Roosevelt, when he went on the radio on March 12, 1933, to explain the four-day "banking holiday." In a time of panic, Roosevelt calmly explained how the banking system worked, structurally. "Let me state the simple fact that when you deposit money in a bank the bank does not put the money into a safe-deposit vault," he said. "It invests your money in many different forms of credit— bonds, mortgages. In other words, the bank puts your money to work to keep the wheels turning around . . ." He explained how banks were required to maintain reserves, but how those reserves were inadequate if there were widespread withdrawals; and why closing the banks for four days was

necessary to restore order. In so doing, he generated public support for a radical but necessary action, and began his reputation as a master of public communication.[20]

The reason that structural explanations are so important is that only they address the underlying causes of behavior at a level that patterns of behavior *can be changed.* Structure produces behavior, and changing underlying structures can produce different patterns of behavior. In this sense, structural explanations are inherently *generative.* Moreover, since structure in human systems includes the "operating policies" of the decision makers in the system, redesigning our own decision making redesigns the system structure.[21]

For most players of the game, the deepest insight usually comes when they realize that their problems, *and* their hopes for improvement, are inextricably tied to how they think. Generative learning cannot be sustained in an organization where event thinking predominates. It requires a conceptual framework of "structural" or systemic thinking, the ability to discover structural causes of behavior. Enthusiasm for "creating our future" is not enough.

As the players in the beer game come to understand the structures that cause its behavior, they see more clearly their power to change that behavior, to adopt ordering policies that work in the larger system. They also discover a bit of timeless wisdom delivered years ago by Walt Kelly in his famous line from "Pogo": "We have met the enemy and he is us."

4

THE LAWS OF THE FIFTH DISCIPLINE[1]

1. *Today's problems come from yesterday's "solutions."*

Once there was a rug merchant who saw that his most beautiful carpet had a large bump in its center.[2] He stepped on the bump to flatten it out—and succeeded. But the bump reappeared in a new spot not far away. He jumped on the bump again, and it disappeared —for a moment, until it emerged once more in a new place. Again and again he jumped, scuffing and mangling the rug in his frustration; until finally he lifted one corner of the carpet and an angry snake slithered out.

Often we are puzzled by the causes of our problems; when we merely need to look at our own solutions to other problems in the past. A well-established firm may find that this quarter's sales are off sharply. Why? Because the highly successful rebate program last quarter led many customers to buy then rather than now. Or a new manager attacks chronically high inventory costs and "solves" the problem—except that the salesforce is now spending 20 percent more time responding to angry complaints from customers who are

still waiting for late shipments, and the rest of its **time trying** to **convince** prospective customers that they can have "any color they want so long as it's black."

Police enforcement officials will recognize their own version of this law: arresting narcotics dealers on Thirtieth Street, they find that they have simply transferred the crime center to Fortieth Street. Or, even more insidiously, they learn that a new citywide outbreak of drug-related crime is the result of federal officials intercepting a large shipment of narcotics—which reduced the drug supply, drove up the price, and caused more crime by addicts desperate to maintain their habit.

Solutions that merely shift problems from one part of a system to another often go undetected because, unlike the rug merchant, those who "solved" the first problem are different from those who inherit the new problem.

2. The harder you push, the harder the system pushes back.

In George Orwell's *Animal Farm,* the horse Boxer always had the same answer to any difficulty: "I will work harder," he said. At first, his well-intentioned diligence inspired everyone, but gradually, his hard work began to backfire in subtle ways. The harder he worked, the more work there was to do. What he didn't know was that the pigs who managed the farm were actually manipulating them all for their own profit. Boxer's diligence actually helped to keep the other animals from seeing what the pigs were doing.[3] Systems thinking has a name for this phenomenon: "Compensating feedback": when well-intentioned interventions call forth responses from the system that offset the benefits of the intervention. We all know what it feels like to be facing compensating feedback—the harder you push, the harder the system pushes back; the more effort you expend trying to improve matters, the more effort seems to be required.

Examples of compensating feedback are legion. Many of the best intentioned government interventions fall prey to compensating feedback. In the 1960s there were massive programs to build low-income housing and improve job skills in decrepit inner cities in the United States. Many of these cities were even worse off in the 1970s despite the largesse of government aid. Why? One reason was that low-income people migrated from other cities and from rural areas to those cities with the best aid programs. Eventually, the new housing units became overcrowded and the job training programs were

swamped with applicants. All the while, the city's **tax base continued to erode,** leaving more people trapped in economically **depressed areas.**

Similar compensating feedback processes have operated to **thwart food** and agricultural assistance to developing countries. More food available has been "compensated for" by reduced deaths due to malnutrition, higher net population growth, and eventually more malnutrition.

Similarly, efforts to correct the U.S. trade imbalance by letting the value of the dollar fall in the mid-1980s were compensated for by foreign competitors who let prices of their goods fall in parallel (for countries whose currency was "pegged to the dollar," their prices adjusted automatically). Efforts by foreign powers to suppress indigenous guerrilla fighters often lead to further legitimacy for the guerrillas' cause, thereby strengthening their resolve and support, and leading to still further resistance.

Many companies experience compensating feedback when one of their products suddenly starts to lose its attractiveness in the market. They push for more aggressive marketing; that's what always worked in the past, isn't it? They spend more on advertising, and drop the price; these methods may bring customers back temporarily, but they also draw money away from the company, so it cuts corners to compensate. The quality of its service (say, its delivery speed or care in inspection) starts to decline. In the long run, the more fervently the company markets, the more customers it loses.

Nor is compensating feedback limited to "large systems"—there are plenty of personal examples. Take the person who quits smoking only to find himself gaining weight and suffering such a loss in self-image that he takes up smoking again to relieve the stress. Or the protective mother who wants so much for her young son to get along with his schoolmates that she repeatedly steps in to resolve problems and ends up with a child who never learns to settle differences by himself. Or the enthusiastic newcomer so eager to be liked that she never responds to subtle criticisms of her work and ends up embittered and labeled "a difficult person to work with."

Pushing harder, whether through an increasingly aggressive intervention or through increasingly stressful withholding of natural instincts, is exhausting. Yet, as individuals and organizations, we not only get drawn into compensating feedback, we often glorify the suffering that ensues. When our initial efforts fail to produce lasting improvements, we "push harder"—faithful, as was Boxer, to the

creed that hard work will overcome all obstacles, all the while blinding ourselves to how we are contributing to the obstacles ourselves.

3. *Behavior grows better before it grows worse.*

Low-leverage interventions would be much less alluring if it were not for the fact that many actually work, in the short term. New houses get built. The unemployed are trained. Starving children are spared. Lagging orders turn upward. We stop smoking, relieve our child's stress, and avoid a confrontation with a new coworker. Compensating feedback usually involves a "delay," a time lag between the short-term benefit and the long-term disbenefit. *The New Yorker* once published a cartoon in which a man sitting in an armchair pushes over a giant domino encroaching upon him from the left. "At last, I can relax," he's obviously telling himself in the cartoon. Of course, he doesn't see that the domino is toppling another domino, which in turn is about to topple another, and another, and that the chain of dominoes behind him will eventually circle around his chair and strike him from the right.

The better before worse response to many management interventions is what makes political decision making so counterproductive. By "political decision making," I mean situations where factors other than the intrinsic merits of alternative courses of action weigh in making decisions—factors such as building one's own power base, or "looking good," or "pleasing the boss." In complex human systems there are always many ways to make things look better in the short run. Only eventually does the compensating feedback come back to haunt you.

The key word is "eventually." The delay in, for example, the circle of dominoes, explains why systemic problems are so hard to recognize. A typical solution feels wonderful, when it first cures the symptoms. Now there's improvement; or maybe even the problem has gone away. It may be two, three, or four years before the problem returns, or some new, worse problem arrives. By that time, given how rapidly most people move from job to job, someone new is sitting in the chair.

4. *The easy way out usually leads back in.*

In a modern version of an ancient Sufi story, a passerby encounters a drunk on his hands and knees under a street lamp. He offers to help and finds out that the drunk is looking for his house keys. After

several minutes, he asks, "Where did you drop them?" The drunk replies that **he dropped** them outside his front door. "Then why **look** for them here?" asks the passerby. "Because," says the drunk, "there is no light by my doorway."

We all find comfort applying familiar solutions to problems, sticking to what we know best. Sometimes the keys are indeed under the street lamp; but very often they are off in the darkness. After all, if the solution *were* easy to see or obvious to everyone, it probably would already have been found. Pushing harder and harder on familiar solutions, while fundamental problems persist or worsen, is a reliable indicator of nonsystemic thinking—what we often call the "what we need here is a bigger hammer" syndrome.

5. *The cure can be worse than the disease.*

Sometimes the easy or familiar solution is not only ineffective; sometimes it is addictive and dangerous. Alcoholism, for instance, may start as simple social drinking—a solution to the problem of low self-esteem or work-related stress. Gradually, the cure becomes worse than the disease; among its other problems it makes self-esteem and stress even worse than they were to begin with.

The long-term, most insidious consequence of applying nonsystemic solutions is increased need for more and more of the solution. This is why ill-conceived government interventions are not just inef- -fective, they are "addictive" in the sense of fostering increased dependency and lessened abilities of local people to solve their own problems. The phenomenon of short-term improvements leading to long-term dependency is so common, it has its own name among systems thinkers—it's called "Shifting the Burden to the Inter-venor." The intervenor may be federal assistance to cities, food relief agencies, or welfare programs. All "help" a host system, only to leave the system fundamentally weaker than before and more in need of further help.

Finding examples of shifting the burden to the intervenor, as natural resource expert and writer Donella Meadows says, "is easy and fun and sometimes horrifying"[4] and hardly limited to government intervenors. We shift the burden of doing simple math from our knowledge of arithmetic to a dependency on pocket calculators. We take away extended families, and shift the burden for care of the aged to nursing homes. In cities, we shift the burden from diverse local communities to housing projects. The Cold War shifted respon-

sibility for peace from negotiation to armaments, thereby **strengthening** the military and related industries. In business, we can shift the burden to consultants or other "helpers" who make the company dependent on them, instead of training the client managers to solve problems themselves. Over time, the intervenor's power grows—whether it be a drug's power over a person, or the military budget's hold over an economy, the size and scope of foreign assistance agencies, or the budget of organizational "relief agencies."

Shifting the Burden structures show that any long-term solution must, as Meadows says, "strengthen the ability of the system to shoulder its own burdens." Sometimes that is difficult; other times it is surprisingly easy. A manager who has shifted the burden of his personnel problems onto a Human Relations Specialist may find that the hard part is deciding to take the burden back; once that happens, learning how to handle people is mainly a matter of time and commitment.

6. *Faster is slower.*

This, too, is an old story: the tortoise may be slower, but he wins the race. For most American business people the best rate of growth is fast, faster, fastest. Yet, virtually all natural systems, from ecosystems to animals to organizations, have intrinsically optimal rates of growth. The optimal rate is far less than the fastest possible growth. When growth becomes excessive—as it does in cancer—the system itself will seek to compensate by slowing down; perhaps putting the organization's survival at risk in the process. In Chapter 8, the story of People Express airlines offers a good example of how faster can lead to slower—or even full stop—in the long run.

Observing these characteristics of complex systems, noted biologist and essayist Lewis Thomas has observed, "When you are dealing with a complex social system, such as an urban center or a hamster, with things about it that you are dissatisfied with and eager to fix, you cannot just step in and set about fixing with much hope of helping. This realization is one of the sore discouragements of our century."[5]

When managers first start to appreciate how these systems principles have operated to thwart many of their own favorite interventions, they can be discouraged and disheartened. The systems principles can even become excuses for inaction—for doing nothing

rather than possibly **taking** actions that might backfire, or even **make matters worse. This is a classic case of "a little knowledge being a dangerous thing." For the** real implications of **the** systems **perspective are not** inaction but a new type of action rooted in a **new way of thinking**—systems thinking is both more challenging *and* **more promising** than our normal ways of dealing with problems.

7. *Cause and effect are not closely related in time and space.*

Underlying all of the above problems is a fundamental characteristic of complex human systems: "cause" and "effect" are not close in time and space. By "effects," I mean the obvious symptoms that indicate that there are problems—drug abuse, unemployment, starving children, falling orders, and sagging profits. By "cause" I mean the interaction of the underlying system that is most responsible for generating the symptoms, and which, if recognized, could lead to changes producing lasting improvement. Why is this a problem? Because most of us assume they *are*—most of us assume, most of the time, that cause and effect *are* close in time and space.

When we play as children, problems are never far away from their solutions—as long, at least, as we confine our play to one group of toys. Years later, as managers, we tend to believe that the world works the same way. If there is a problem on the manufacturing line, we look for a cause in manufacturing. If salespeople can't meet targets, we think we need new sales incentives or promotions. If there is inadequate housing, we build more houses. If there is inadequate food, the solution must be more food.

As the players in the beer game described in Chapter 3 eventually discover, the root of our difficulties is neither recalcitrant problems nor evil adversaries—but ourselves. There is a fundamental mismatch between the nature of reality in complex systems and our predominant ways of thinking about that reality. The first step in correcting that mismatch is to let go of the notion that cause and effect are close in time and space.

8. *Small changes can produce big results—but the areas of highest leverage are often the least obvious.*

Some have called systems thinking the "new dismal science" because it teaches that most obvious solutions don't work—at best, they improve matters in the short run, only to make things worse in the long run. But there is another side to the story. For systems

thinking also shows that small, well-focused actions can sometimes produce significant, enduring improvements, if they're in the right place. Systems thinkers refer to this principle as "leverage."

Tackling a difficult problem is often a matter of seeing where the high leverage lies, a change which—with a minimum of effort—would lead to lasting, significant improvement.

The only problem is that high-leverage changes are usually highly *nonobvious* to most participants in the system. They are not "close in time and space" to obvious problem symptoms. This is what makes life interesting.

Buckminster Fuller had a wonderful illustration of leverage that also served as his metaphor for the principle of leverage—the "trim tab." A trim tab is a small "rudder on the rudder" of a ship. It is only a fraction the size of the rudder. Its function is to make it easier to turn the rudder, which, then, makes it easier to turn the ship. The larger the ship, the more important is the trim tab because a large volume of water flowing around the rudder can make it difficult to turn.

But what makes the trim tab such a marvelous metaphor for leverage is not just its effectiveness, but its nonobviousness. If you knew absolutely nothing about hydrodynamics and you saw a large oil tanker plowing through the high seas, where would you push if you wanted the tanker to turn left? You would probably go to the bow and try to push it to the left. Do you have any idea how much force it requires to turn an oil tanker going fifteen knots by pushing on its bow? The leverage lies in going to the stern and pushing the tail end of the tanker to the right, in order to turn the front to the left. This, of course, is the job of the rudder. But in what direction does the rudder turn in order to get the ship's stern to turn to the right? Why to the left, of course.

You see, ships turn because their rear end is "sucked around." The rudder, by being turned into the oncoming water, compresses the water flow and creates a pressure differential. The pressure differential pulls the stern in the opposite direction as the rudder is turned. This is exactly the same way that an airplane flies: the airplane's wing creates a pressure differential and the airplane is "sucked" upward.

The trim tab—this very small device that has an enormous effect on the huge ship—does the same for the rudder. When it is turned to one side or the other, it compresses the water flowing around the rudder and creates a small pressure differential that "sucks the rud-

der" in the desired direction. But, if you want the rudder to turn to **the** left, what direction do you turn the trim tab?—to the right, naturally.

The entire system—the ship, the rudder, and the trim tab—is marvelously engineered through the principle of leverage. Yet, its functioning is totally nonobvious if you do not understand the force of hydrodynamics.

So, too, are the high-leverage changes in human systems nonobvious *until* we understand the forces at play in those systems.

There are no simple rules for finding high-leverage changes, but there are ways of thinking that make it more likely. Learning to see underlying "structures" rather than "events" is a starting point; each of the "systems archetypes" developed below suggests areas of high- and low-leverage change.

Thinking in terms of processes of change rather than "snapshots" is another.

9. *You* can *have your cake and eat it too—but not at once.*

Sometimes, the knottiest dilemmas, when seen from the systems point of view, aren't dilemmas at all. They are artifacts of "snapshot" rather than "process" thinking, and appear in a whole new light once you think consciously of change over time.

For years, for example, American manufacturers thought they had to choose between low cost and high quality. "Higher quality products cost more to manufacture," they thought. "They take longer to assemble, require more expensive materials and components, and entail more extensive quality controls." What they didn't consider was all the ways the increasing quality and lowering costs could go hand in hand, over time. What they didn't consider was how basic improvements in work processes could eliminate rework, eliminate quality inspectors, reduce customer complaints, lower warranty costs, increase customer loyality, and reduce advertising and sales promotion costs. They didn't realize that they could have both goals, if they were willing to wait for one while they focused on the other. Investing time and money to develop new skills and methods of assembly, including new methods for involving everyone responsible for improving quality, is an up front "cost." Quality and costs may *both* go up in the ensuing months; although some cost savings (like reduced rework) may be achieved fairly quickly, the full range of cost savings may take several years to harvest.

Many apparent dilemmas, such as central versus local control, and **happy** committed employees versus competitive labor costs, and rewarding individual achievement versus having everyone feel valued are by-products of static thinking. They only appear as rigid "either-or" choices, because we think of what is possible at a fixed point in time. Next month, it may be true that we must choose one or the other, but the real leverage lies in seeing how both can improve over time.[6]

10. *Dividing an elephant in half does not produce two small elephants.*

Living systems have integrity. Their character depends on the whole. The same is true for organizations; to understand the most challenging managerial issues requires seeing the whole system that generates the issues.

Another Sufi tale illustrates the point of this law. As three blind men encountered an elephant, each exclaimed aloud. "It is a large rough thing, wide and broad, like a rug," said the first, grasping an ear. The second, holding the trunk, said, "I have the real facts. It is a straight and hollow pipe." And the third, holding a front leg, said, "It is mighty and firm, like a pillar." Are the three blind men any different from the heads of manufacturing, marketing, and research in many companies? Each sees the firm's problems clearly, but none see how the policies of their department interact with the others. Interestingly, the Sufi story concludes by observing that "Given these men's way of knowing, they will never know an elephant."

Seeing "whole elephants" does not mean that every organizational issue can be understood only by looking at the entire organization. Some issues *can* be understood only by looking at how major functions such as manufacturing, marketing, and research interact; but there are other issues where critical systemic forces arise within a given functional area; and others where the dynamics of an entire industry must be considered. The key principle, called the "principle of the system boundary," is that the interactions that must be examined are those most important to the issue at hand, *regardless* of parochial organizational boundaries.

What makes this principle difficult to practice is the way organizations are designed to keep people from seeing important interactions. One obvious way is by enforcing rigid internal divisions that inhibit inquiry across divisional boundaries, such as those that grow up between marketing, manufacturing, and research. Another is by

"leaving" problems behind us, for someone else to clean up. Many European cities have avoided the problems of crime, entrenched poverty, and helplessness that afflict so many American inner cities because they have forced themselves to face the balances that a healthy urban area must maintain. One way they have done this is by maintaining large "green belts" around the city that discourage the growth of suburbs and commuters who work in the city but live outside it. By contrast, many American cities have encouraged steady expansion of surrounding suburbs, continually enabling wealthier residents to move further from the city center and its problems. (Impoverished areas today, such as Harlem in New York and Roxbury in Boston were originally upper-class suburbs.) Corporations do the same thing by continually acquiring new businesses and "harvesting" what they choose to regard as "mature" businesses rather than reinvesting in them.

Incidentally, sometimes people go ahead and divide an elephant in half anyway. You don't have two small elephants then; you have a mess. By a mess, I mean a complicated problem where there is no leverage to be found because the leverage lies in interactions that cannot be seen from looking only at the piece you are holding.

11. *There is no blame.*

We tend to blame outside circumstances for our problems. "Someone else"—the competitors, the press, the changing mood of the marketplace, the government—did it to us. Systems thinking shows us that there is no outside; that you and the cause of your problems are part of a single system. The cure lies in your relationship with your "enemy."

5

A SHIFT OF MIND

SEEING THE WORLD ANEW

There is something in all of us that loves to put together a puzzle, that loves to see the image of the whole emerge. The beauty of a person, or a flower, or a poem lies in seeing all of it. It is interesting that the words "whole" and "health" come from the same root (the Old English *hal,* as in "hale and hearty"). So it should come as no surprise that the unhealthiness of our world today is in direct proportion to our inability to see it as a whole.

Systems thinking is a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static "snapshots." It is a set of general principles—distilled over the course of the twentieth century, spanning fields as diverse as the physical and social sciences, engineering, and management. It is also a set of specific tools and techniques, originating in two threads: in "feedback" concepts of cybernetics and in "servomechanism" engineering theory dating back to the nineteenth century. During the last thirty years, these tools have

been applied to understand a wide range of corporate, urban, **regional,** economic, political, ecological, and even physiological systems.[1] And systems thinking is a sensibility—for the subtle interconnectedness that gives living systems their unique character.

Today, systems thinking is needed more than ever because we are becoming overwhelmed by complexity. Perhaps for the first time in history, humankind has the capacity to create far more information than anyone can absorb, to foster far greater interdependency than anyone can manage, and to accelerate change far faster than anyone's ability to keep pace. Certainly the scale of complexity is without precedent. All around us are examples of "systemic breakdowns"—problems such as global warming, ozone depletion, the international drug trade, and the U.S. trade and budget deficits — problems that have no simple local cause. Similarly, organizations break down, despite individual brilliance and innovative products, because they are unable to pull their diverse functions and talents into a productive whole.

Complexity can easily undermine confidence and responsibility— as in the frequent refrain, "It's all too complex for me," or "There's nothing I can do. It's the system." Systems thinking is the antidote to this sense of helplessness that many feel as we enter the "age of interdependence." Systems thinking is a discipline for seeing the "structures" that underlie complex situations, and for discerning high from low leverage change. That is, by seeing wholes we learn how to foster health. To do so, systems thinking offers a language that begins by restructuring how we think.

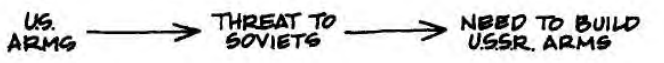
I call systems thinking the fifth discipline because it is the conceptual cornerstone that underlies all of the five learning disciplines of this book. All are concerned with a shift of mind from seeing parts to seeing wholes, from seeing people as helpless reactors to seeing them as active participants in shaping their reality, from reacting to the present to creating the future. Without systems thinking, there is neither the incentive nor the means to integrate the learning disciplines once they have come into practice. As the fifth discipline, systems thinking is the cornerstone of how learning organizations think about their world.

There is no more poignant example of the need for systems thinking than the U.S.-U.S.S.R. arms race. While the world has stood and watched for the past forty years, the two mightiest political powers have engaged in a race to see who could get fastest to where no one wanted to go. I have not yet met a person who is in favor of

the arms race. Even those who regard it as absolutely necessary, or who profit from it, **will,** in their quieter moments, confess that **they** wish it were not necessary. It has drained the U.S. economy and devastated the Soviet economy. It has ensnared successive administrations of political leaders, and terrified two generations of the world's citizens.

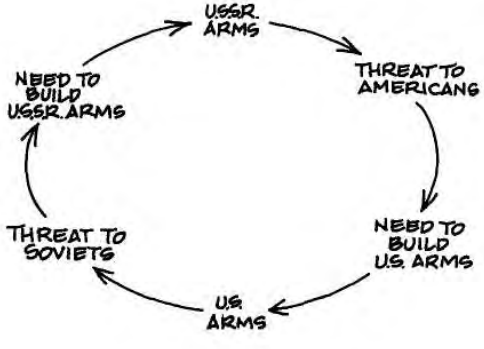
The roots of the arms race lie not in rival political ideologies, nor in nuclear arms, but in a way of thinking both sides have shared. The United States establishment, for example, has had a viewpoint of the arms race that essentially resembled the following:

At the same time, the Soviet leaders have had a view of the arms race somewhat resembling this:



From the American viewpoint, the Soviets have been the aggressor, and U.S. expansion of nuclear arms has been a defensive response to the threats posed by the Soviets. From the Soviet viewpoint, the United States has been the aggressor, and Soviet expansion of nuclear arms has been a defensive response to the threat posed by the Americans.

But the two straight lines form a circle. The two nations' individual, "linear," or nonsystemic viewpoints interact to create a "system," a set of variables that influence one another:



The systems view of **the** arms race shows a perpetual cycle of **aggression. The** United States responds to a perceived Threat to Americans by increasing U.S. arms, which increases the Threat to **the** Soviets, which leads to more Soviet arms, which increases the Threat to the United States, which leads to more U.S. arms, which increases the Threat to the Soviets, which . . . and so on, and so on. From their individual viewpoints, each side achieves its short-term goal. Both sides respond to a perceived threat. But their actions end up creating the opposite outcome, increased threat, in the long run. Here, as in many systems, *doing the obvious thing does not produce the obvious, desired outcome.* The long-term result of each side's efforts to be more secure is heightened insecurity for all, with a combined nuclear stockpile of ten thousand times the total firepower of world War II.

Interestingly, both sides failed for years to adopt a true systems view, despite an abundance of "systems analysts," sophisticated analyses of each others' nuclear arsenals, and complex computer simulations of attack and counterattack war scenarios.[2] Why then have these supposed tools for dealing with complexity not empowered us to escape the illogic of the arms race?

The answer lies in the same reason that sophisticated tools of forecasting and business analysis, as well as elegant strategic plans, usually fail to produce dramatic breakthroughs in managing a business. They are all designed to handle the sort of complexity in which there are many variables: *detail complexity. But there are two types of complexity.* The second type is *dynamic complexity,* situations where cause and effect are subtle, and where the effects over time of interventions are not obvious. Conventional forecasting, planning, and analysis methods are not equipped to deal with dynamic complexity. Mixing many ingredients in a stew involves detail complexity, as does following a complex set of instructions to assemble a machine, or taking inventory in a discount retail store. But none of these situations is especially complex dynamically.

When the same action has dramatically different effects in the short run and the long, there is dynamic complexity. When an action has one set of consequences locally and a very different set of consequences in another part of the system, there is dynamic complexity. When obvious interventions produce nonobvious consequences, there is dynamic complexity. A gyroscope is a dynamically complex machine: If you push downward on one edge, it moves to the left; if you push another edge to the left, it moves upward. Yet, how trivi-

ally simple is a gyroscope when compared with the complex dynamics of an enterprise, where it takes days to produce something, weeks to develop a new marketing promotion, months to hire and train new people, and years to develop new products, nurture management talent, and build a reputation for quality—and all of these processes interact continually.

The real leverage in most management situations lies in understanding dynamic complexity, not detail complexity. Balancing market growth and capacity expansion is a dynamic problem. Developing a profitable mix of price, product (or service) quality, design, and availability that make a strong market position is a dynamic problem. Improving quality, lowering total costs, and satisfying customers in a sustainable manner is a dynamic problem.

Unfortunately, most "systems analyses" focus on detail complexity not dynamic complexity. Simulations with thousands of variables and complex arrays of details can actually distract us from seeing patterns and major interrelationships. In fact, sadly, for most people "systems thinking" means "fighting complexity with complexity," devising increasingly "complex" (we should really say "detailed") solutions to increasingly "complex" problems. In fact, this is the antithesis of real systems thinking.

The arms race is, most fundamentally, a problem of dynamic complexity. Insight into the causes and possible cures requires seeing the interrelationships, such as between our actions to become more secure and the threats they create for the Soviets. It requires seeing the delays between action and consequence, such as the delay between a U.S. decision to build up arms and a consequent Soviet counterbuildup. And it requires seeing patterns of change, not just snapshots, such as continuing escalation.

Seeing the major interrelationships underlying a problem leads to new insight into what might be done. In the case of the arms race, as in any escalation dynamic, the obvious question is, "Can the vicious cycle be run in reverse?" "Can the arms race be run backward?"

This may be just what is happening today. Soviet General Secretary Mikhail Gorbachev's initiatives in arms reduction have started a new "peace race" with both sides eager to keep pace with the other's reductions in nuclear arsenals. It is too early to tell whether the shifts in policy initiated by the Soviets in 1988 and 1989 will initiate a sustained unwinding of the U.S.-U.S.S.R. arms race. There

are many other factors in **the** global geopolitical system beyond **the pure** U.S.-U.S.S.R. interaction. But we appear to be witnessing **the first glimmer** of a genuinely systemic approach.[3]

The essence of the discipline of systems thinking lies in a shift of **mind:**

- seeing interrelationships rather than linear cause-effect chains, and
- seeing processes of change rather than snapshots

The practice of systems thinking starts with understanding a simple concept called "feedback" that shows how actions can reinforce or counteract (balance) each other. *It builds to learning to recognize types of "structures" that recur again and again:* the arms race is a generic or archetypal pattern of escalation, at its heart no different from turf warfare between two street gangs, the demise of a marriage, or the advertising battles of two consumer goods companies fighting for market share. Eventually, systems thinking forms a rich language for describing a vast array of interrelationships and patterns of change. Ultimately, *it simplifies life* by helping us see the deeper patterns lying behind the events and the details.

Learning any new language is difficult at first. But as you start to master the basics, it gets easier. Research with young children has shown that many learn systems thinking remarkably quickly.[4] It appears that we have latent skills as systems thinkers that are undeveloped, even repressed by formal education in linear thinking. Hopefully, what follows will help rediscover some of those latent skills and bring to the surface the systems thinker that is within each of us.

SEEING CIRCLES OF CAUSALITY[5]

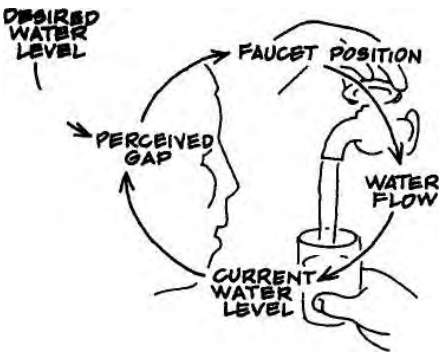
Reality is made up of circles but we see straight lines. Herein lie the beginnings of our limitation as systems thinkers. One of the reasons for this fragmentation in our thinking stems

from our language. Language shapes perception. **What we** *see* **depends** on what we are prepared to see. Western languages, with **their** subject-verb-object structure, are biased toward a linear view.[6] If we want to see systemwide interrelationships, we need a language of interrelationships, a language made up of circles. Without such a language, our habitual ways of seeing the world produce fragmented views and counterproductive actions—as it has done for decision makers in the arms race. Such a language is important in facing dynamically complex issues and strategic choices, especially when individuals, teams, and organizations need to see beyond events and into the forces that shape change.

To illustrate the rudiments of the new language, consider a very simple system—filling a glass of water. You might think, "That's not a system—it's too simple." But think again.

From the linear viewpoint, we say, "I am filling a glass of water." What most of us have in mind looks pretty much like the following picture:

But, in fact, as we fill the glass, we are watching the water level rise. We monitor the "gap" between the level and our goal, the "desired water level." As the water approaches the desired level, we adjust the faucet position to slow the flow of water, until it is turned off when the glass is full. In fact, when we fill a glass of water we operate in a "water-regulation" system involving five variables: our desired water level, the glass's current water level, the gap between the two, the faucet position, and the water flow. These variables are organized in a circle or loop of cause-effect relationships which is called a "feedback process." The process operates continuously to bring the water level to its desired level:

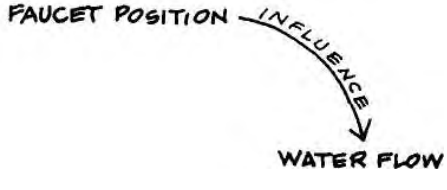


People get confused about "feedback" because we often use the word in a somewhat different way—to gather opinions about an act we have undertaken. "Give me some feedback on the brewery decision," you might say. "What did you think of the way I handled it?" In that context, "positive feedback" means encouraging remarks and "negative feedback" means bad news. But in systems thinking, feedback is a broader concept. It means any reciprocal flow of influence. In systems thinking it is an axiom that every influence is both *cause* and *effect*. Nothing is ever influenced in just one direction.

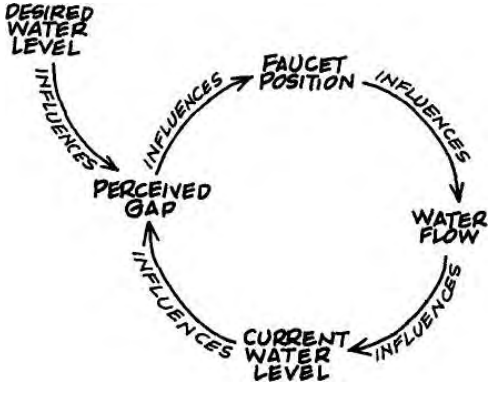
HOW TO READ A SYSTEMS DIAGRAM

The key to seeing reality systemically is seeing circles of influence rather than straight lines. This is the first step to breaking out of the reactive mindset that comes inevitably from "linear" thinking. Every circle tells a story. By tracing the flows of influence, you can see patterns that repeat themselves, time after time, making situations better or worse.

From any element in a situation, you can trace arrows that represent influence on another element:



Above, the faucet position arrow points **to water flow. Any change made to the** faucet position will alter the flow of water. But arrows never exist in isolation:



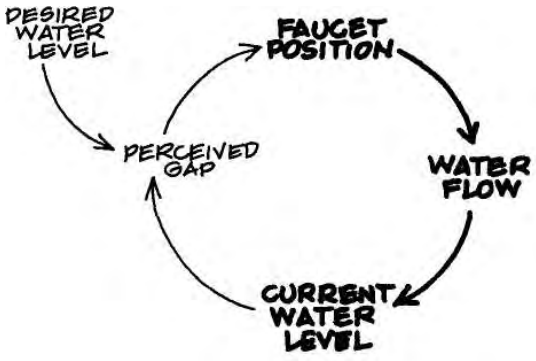
To follow the story, start at any element and watch the action ensue, circling as the train in a toy railroad does through its recurring journey. A good place to start is with the action being taken by the decision maker:

I set the faucet position, which adjusts the water flow, which changes the water level. As the water level changes, the perceived gap (between the current and desired water levels) changes. As the gap changes, my hand's position on the faucet changes again. And so on . . .

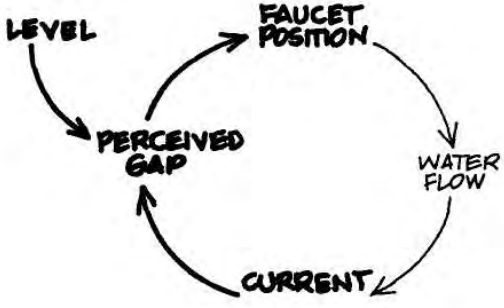
When reading a feedback circle diagram, the main skill is to see the "story" that the diagram tells: how the structure creates a particular pattern of behavior *(or,* in a complex structure, several patterns of behavior) and how that pattern might be influenced. Here the story is filling the water glass and gradually closing down the faucet as the glass fills.

Though simple in concept, the feedback loop overturns deeply ingrained ideas—such as causality. In everyday English we say, "I am filling the glass of water" without thinking very deeply about the **real** meaning of the statement. It implies a one-way causality—"I

am causing the water level to rise." More precisely, "My hand on the faucet is controlling the rate of flow of water into the glass." Clearly, this statement describes only half of the feedback process: **the** linkages from "faucet position" to "flow of water" to "water **level."**



But it would be just as true to describe only the other "half" of the process: "The level of water in the glass is controlling my hand."



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Both statements are equally incomplete. The more complete statement of causality is that my intent to fill a glass of water creates a system that causes water to flow in when the level is low, then shuts the flow off when the glass is full. In other words, the structure causes the behavior. This distinction is important because seeing only individual actions and missing the structure underlying the actions, as we saw in the beer game in Chapter 3, lies at the root of our powerlessness in complex situations.

In fact, all causal attributions made in everyday **English are highly** suspect! Most are embedded in linear ways of seeing. They are at best partially accurate, inherently biased toward describing portions of reciprocal processes, not the entire processes.

Another idea overturned by the feedback perspective is anthropocentrism—or seeing ourselves as the center of activities. The simple description, "I am filling the glass of water," suggests a world of human actors standing at the center of activity, operating on an inanimate reality. *From the systems perspective, the human actor is part of the feedback process, not standing apart from it. This represents a profound shift in awareness.* It allows us to see how we are continually both influenced by and influencing our reality. It is the shift in awareness so ardently advocated by ecologists in their cries that we see ourselves as part of nature, not separate from nature. It is the shift in awareness recognized by many (but not all) of the world's great philosophical systems—for example, the *Bhagavad Gita's* chastisement:

> All actions are wrought by the qualities of nature only. The self, deluded by egoism, thinketh: "I am the doer."[7]

In addition, the feedback concept complicates the ethical issue of responsibility. In the arms race, who is responsible? From each side's linear view, responsibility clearly lies with the other side: "It is their aggressive actions, and their nationalistic intent, that are causing us to respond by building our arms." A linear view always suggests a simple locus of responsibility. When things go wrong, this is seen as blame—"he, she, it did it"—or guilt—"I did it." At a deep level, there is no difference between blame and guilt, for both spring from linear perceptions. From the linear view, we are always looking for someone or something that must be responsible—they can even be directed toward hidden agents within ourselves. When my son was four years old, he used to say, "My stomach won't let me eat it," when turning down his vegetables. We may chuckle, but is his assignment of responsibility really different from the adult who says, "My neuroses keep me from trusting people."

In mastering systems thinking, we give up the assumption that there must be an individual, or individual agent, responsible. The feedback perspective suggests that *everyone shares responsibility for problems generated by a system.* That doesn't necessarily imply that everyone involved can exert equal leverage in changing the system.

But it does imply **that the** search for scapegoats—a particularly alluring pastime in individualistic cultures such as ours in the United States—is a blind alley.

Finally, the feedback concept illuminates the limitations of our language. When we try to describe in words even a very simple system, such as filling the water glass, it gets very awkward: "When I fill a glass of water, there is a feedback process that causes me to adjust the faucet position, which adjusts the water flow and feeds back to alter the water position. The goal of the process is to make the water level rise to my desired level." This is precisely why a new language for describing systems is needed. If it is this awkward to describe a system as simple as filling a water glass, *imagine our difficulties using everyday English to describe the multiple feedback processes in an organization.*

All this takes some getting used to. We are steeped in a linear language for describing our experience. We find simple statements about causality and responsibility familiar and comfortable. It is not that they must be given up, anymore than you give up English to learn French. There are many situations where simple linear descriptions suffice and looking for feedback processes would be a waste of time. But not when dealing with problems of dynamic complexity.

REINFORCING AND BALANCING FEEDBACK AND DELAYS: THE BUILDING BLOCKS OF SYSTEMS THINKING

There are two distinct types of feedback processes: reinforcing and balancing. *Reinforcing* (or amplifying) feedback processes are the engines of growth. Whenever you are in a situation where things are growing, you can be sure that reinforcing feedback is at work. Reinforcing feedback can also generate accelerating decline—a pattern of decline where small drops amplify themselves into larger and larger drops, such as the decline in bank assets when there is a financial panic.

Balancing (or stabilizing) feedback operates whenever there is a goal-oriented behavior. If the goal is to be not moving, then balancing feedback will act the way the brakes in a car do. If the goal is to be moving at sixty miles per hour, then balancing feedback will cause you to accelerate to sixty but no faster. The "goal" can be an explicit target, as when a firm seeks a desired market share, or it can be

implicit, such as a bad habit, which despite disavowing, we stick to nevertheless.

In addition, many feedback processes contain *"delays,"* interruptions in the flow of influence which make the consequences of actions occur gradually.

All ideas in the language of systems thinking are built up from these elements, just as English sentences are built up from nouns and verbs. Once we have learned the building blocks, we can begin constructing stories: the systems archetypes of the next chapter.

REINFORCING FEEDBACK: DISCOVERING HOW SMALL CHANGES CAN GROW

If you are in a reinforcing feedback system, you may be blind to how small actions can grow into large consequences—for better or for worse. Seeing the system often allows you to influence how it works.

For example, managers frequently fail to appreciate the extent to which their own expectations influence subordinates' performance. If I see a person as having high potential, I give him special attention to develop that potential. When he flowers, I feel that my original assessment was correct and I help him still further. Conversely, those I regard as having lower potential languish in disregard and inattention, perform in a disinterested manner, and further justify, in my mind, the lack of attention I give them.

Psychologist Robert Merton first identified this phenomenon as the "self-fulfilling prophecy."[8] It is also known as the "Pygmalion effect," after the famous George Bernard Shaw play (later to become *My Fair Lady).* Shaw in turn had taken his title from Pygmalion, a character in Greek and Roman mythology, who believed so strongly in the beauty of the statue he had carved that it came to life.

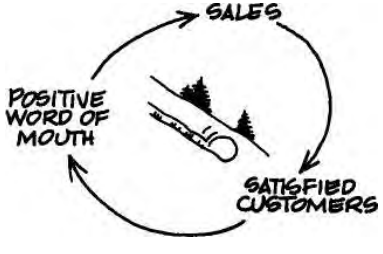
Pygmalion effects have been shown to operate in countless situations.[9] An example occurs in schools, where a teacher's opinion of a student influences the behavior of that student. Jane is shy and does particularly poorly in her first semester at a new school (because her parents were fighting constantly). This leads her teacher to form an opinion that she is unmotivated. Next semester, the teacher pays less attention to Jane and she does poorly again, withdrawing further. Over time, Jane gets caught in an ever-worsening spiral of withdrawal, poor performance, "labeling" by her teachers, inattention, and further withdrawing. Thus, students are unintentionally

"tracked" into a high self-image of their abilities, where they get personal attention, or a low self-image, where their poor class **work is reinforced** in an ever-worsening spiral.

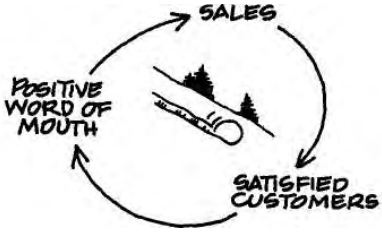
In *reinforcing processes* such as the Pygmalion effect, a small **change** builds on itself. Whatever movement occurs is amplifed, **producing** more movement in the same direction. A small action snowballs, with more and more and still more of the same, resembling compounding interest. Some reinforcing (amplifying) processes are "vicious cycles," in which things start off badly and grow worse. The "gas crisis" was a classic example. Word that gasoline was becoming scarce set off a spate of trips to the local service station, to fill up. Once people started seeing lines of cars, they were convinced that the crisis was here. Panic and hoarding then set in. Before long, everyone was "topping off" their tanks when they were only one-quarter empty, lest they be caught when the pumps went dry. A run on a bank is another example, as are escalation structures such as the arms race or price wars.

But there's nothing inherently bad about reinforcing loops. There are also "virtuous cycles"—processes that reinforce in desired directions. For instance, physical exercise can lead to a reinforcing spiral; you feel better, thus you exercise more, thus you're rewarded by feeling better and exercise still more. The arms race run in reverse, if it can be sustained, makes another virtuous circle. The growth of any new product involves reinforcing spirals. For example, many products grow from "word of mouth." Word of mouth about a product can reinforce a snowballing sense of good feeling (as occurred with the Volkswagen Beetle and more recent Japanese imports) as satisfied customers tell others who then become satisfied customers, who tell still others.

Here is how you might diagram such a process:



HOW TO READ A
REINFORCING CIRCLE

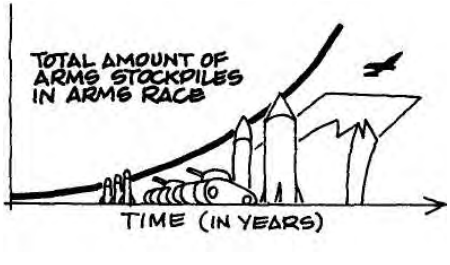


Reinforcing Sales Process Caused by Customers Talking to Each **Other About Your Product**

This diagram shows a reinforcing feedback process wherein actions *snowball.* Again, you can follow the process by walking yourself around the circle:

If the product is a good product, more sales means more satisfied customers, which means more positive word of mouth. That will lead to still more sales, which means even more widespread word of mouth . . . and so on. On the other hand, if the product is defective, the virtuous cycle becomes a vicious cycle: sales lead to less satisfied customers, less positive word of mouth, and less sales; which leads to still less positive word of mouth and less sales.

The behavior that results from a reinforcing loop is either accelerating growth or accelerating decline. For example, the arms race produces an accelerating growth of arms stockpiles:



Positive word of mouth produced rapidly rising sales of **Volkswagens during** the 1950s, and videocassette recorders during the 1980s. A **bank** run produces an accelerating decline in a bank's deposits.

Folk wisdom speaks of reinforcing loops in terms such as "snowball effect," "bandwagon effect," or "vicious circle," and in **phrases** describing particular systems: "the rich get richer and the **poor** get poorer." In business, we know that "momentum is everything," in building confidence in a new product or within a fledgling organization. We also know about reinforcing spirals running the wrong way. "The rats are jumping ship" suggests a situation where, **as** soon as a few people lose confidence, their defection will cause others to defect in a vicious spiral of eroding confidence. Word of mouth can easily work in reverse, and (as occurred with contaminated over-the-counter drugs) produce marketplace disaster.

Both good news and bad news reinforcing loops accelerate so quickly that they often take people by surprise. A French schoolchildren's jingle illustrates the process. First there is just one lily pad in a corner of a pond. But every day the number of lily pads doubles. It takes thirty days to fill the pond, but for the first twenty-eight days, no one even notices. Suddenly, on the twenty-ninth day, the pond is half full of lily pads and the villagers become concerned. But by this time there is littie that can be done. The next day their worst fears come true. That's why environmental dangers are so worrisome, especially those that follow reinforcing patterns (as many environmentalists fear occurs with such pollutants as CFCs). By the time the problem is noticed, it may be too late. Extinctions of species often follow patterns of slow, gradually accelerating decline over long time periods, then rapid demise. So do extinctions of corporations.

But pure accelerating growth or decline rarely continues unchecked in nature, because reinforcing processes rarely occur in isolation. Eventually, limits are encountered—which can slow growth, stop it, divert it, or even reverse it. Even the lily pads stop growing when the limit of the pond's perimeter is encountered. These limits are one form *of balancing feedback,* which, after reinforcing processes, is the second basic element of systems thinking.

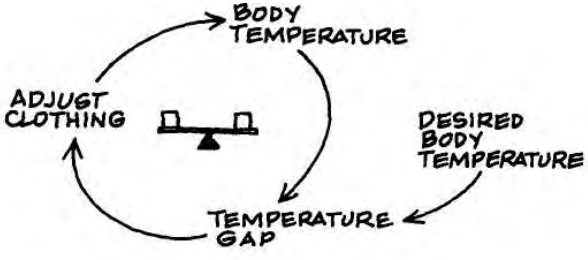
BALANCING PROCESSES: DISCOVERING THE SOURCES OF STABILITY AND RESISTANCE

If you are in a balancing system, you are in a system that is seeking stability. If the system's goal is one you like, you will be happy. If it is not, you will find all your efforts to change matters frustrated— until you can either change the goal or weaken its influence.

Nature loves a balance—but many times, human decision makers act contrary to these balances, and pay the price. For example, managers under budget pressure often cut back staff to lower costs, but eventually discover that their remaining staff is now overworked, and their costs have not gone down at all—because the remaining work has been farmed out to consultants, or because overtime has made up the difference. The reason that costs don't stay down is that *the system has its own agenda.* There is an implicit goal, unspoken but very real—the amount of work that is expected to get done.

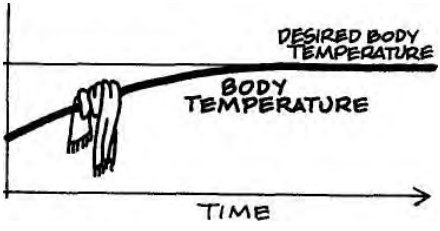
In a balancing (stabilizing) system, there is a self-correction that attempts to maintain some goal or target. Filling the glass of water is a balancing process with the goal of a full glass. Hiring new employees is a balancing process with the goal of having a target work force size or rate of growth. Steering a car and staying upright on a bicycle are also examples of balancing processes, where the goal is heading in a desired direction.

Balancing feedback processes are everywhere. They underlie all goal-oriented behavior. Complex organisms such as the human body contain thousands of balancing feedback processes that maintain temperature and balance, heal our wounds, adjust our eyesight to the amount of light, and alert us to threat. A biologist would say that all of these processes are the mechanisms by which our body achieves *homeostasis*—its ability to maintain conditions for survival

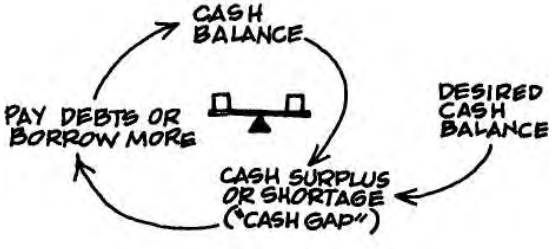


in a changing environment. Balancing feedback prompts us to eat **when we need food, and** to sleep when we need rest, or—as shown in the diagram above—to put on a sweater when we are cold.

As in all balancing processes, the crucial element—our body temperature—gradually adjusts itself toward its desired level:



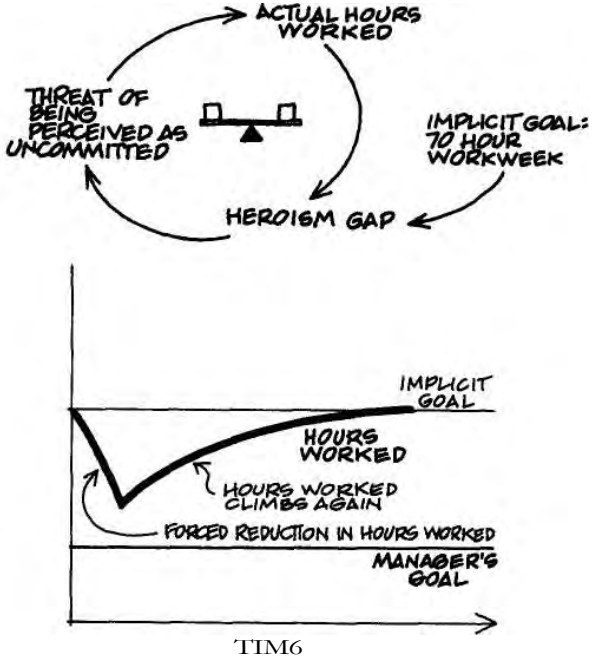
Organizations and societies resemble complex organisms because they too have myriad balancing feedback processes. In corporations, the production and materials ordering process is constantly adjusting in response to changes in incoming orders; short-term (discounts) and long-term (list) prices adjust in response to changes in demand or competitors' prices; and borrowing adjusts with changes in cash balances or financing needs.



Planning creates longer-term balancing processes. A human resource plan might establish long-term growth targets in head count and in skill profile of the work force to match anticipated needs. Market research and R&D plans shape new product development and investments in people, technologies, and capital plant to build competitive advantage.

What makes balancing processes so difficult in management is that the goals are often implicit, and no one recognizes that the balancing process exists at all. I recall a good friend who tried, fruitlessly, to reduce burnout among professionals in his rapidly growing training business. He wrote memos, shortened working hours, even closed

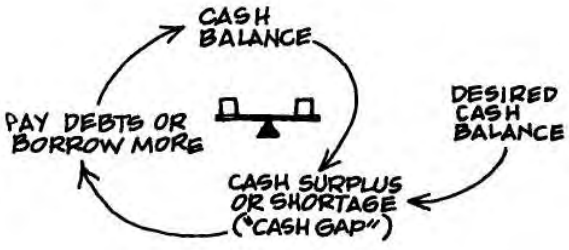
and locked offices earlier—all **attempts** to get **people to stop overworking.** But all these actions were offset—people ignored **the** memos, disobeyed the shortened hours, and took their work home with them when the offices were locked. Why? Because an unwritten norm in the organization stated that the *real* heros, the people who really cared and who got ahead in the organization, worked seventy hours a week—a norm that my friend had established himself by his own prodigious energy and long hours.



TIM6

To understand how an organism works we must understand its balancing processes—those that are explicit *and* implicit. We could master long lists of body parts, organs, bones, veins, and blood vessels and yet we would not understand how the body functions—until we understand how the neuromuscular system maintains balance, or how the cardiovascular system maintains blood pressure and oxygen levels. This is why many attempts to redesign social systems fail. The state-controlled economy fails because it severs the multiple self-correcting processes that operate in a free market system.[10] This is why corporate mergers often fail. When two hospitals in Boston, both with outstanding traditions of patient care, were

HOW TO READ A BALANCING CIRCLE DIAGRAM



This diagram shows a balancing feedback process.

To walk yourself through the process, it's generally easiest to start at the gap—the discrepancy between what is desired and what exists:

Here, there is a shortfall in cash on hand for our cashflow needs. (In other words, there's a gap between our desired and actual cash balances.)

Then look at the actions being taken to correct the gap:

We borrow money, which makes our cash balance larger, and the gap decreases.

The chart shows that a balancing process is always operating to reduce a gap between what is desired and what exists. Moreover, such goals as desired cash balances change over time with growth or decline in the business. Regardless, the balancing process will continue to work to adjust actual cash balances to what is needed, even if the target is moving.

merged several years ago, the new larger hospital **had state-of-the-**art facilities but lost the spirit of personal care and employee loyalty that had characterized the original institutions. In the merged hospital, subtle balancing processes in the older hospitals that monitored quality, paid attention to employee needs, and maintained friendly relationships with patients were disrupted by new administrative structures and procedures.

Though simple in concept, balancing processes can generate surprising and problematic behavior if they go undetected.

In general, balancing loops are more difficult to see than reinforcing loops because it often *looks* like nothing is happening. There's no dramatic growth of sales and marketing expenditures, or nuclear arms, or lily pads. Instead, the balancing process maintains the status quo, even when all participants want change. The feeling, as Lewis Carroll's Queen of Hearts put it, of needing "all the running you can do to keep in the same place," is a clue that a balancing loop may exist nearby.

Leaders who attempt organizational change often find themselves unwittingly caught in balancing processes. To the leaders, it looks as though their efforts are clashing with sudden resistance that seems to come from nowhere. In fact, as my friend found when he tried to reduce burnout, the resistance is a response by the system, trying to maintain an implicit system goal. Until this goal is recognized, the change effort is doomed to failure. So long as the leader continues to be the "model," his work habits will set the norm. Either he must change his habits, or establish new and different models.

Whenever there is "resistance to change," you can count on there being one or more "hidden" balancing processes. Resistance to change is neither capricious nor mysterious. It almost always arises from threats to traditional norms and ways of doing things. Often these norms are woven into the fabric of established power relationships. The norm is entrenched because the distribution of authority and control is entrenched. Rather than pushing harder to overcome resistance to change, artful leaders discern the source of the resistance. They focus directly on the implicit norms and power relationships within which the norms are embedded.

DELAYS: WHEN THINGS HAPPEN . . . EVENTUALLY

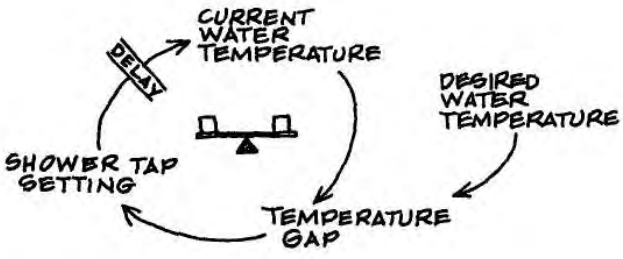
As we've seen, systems seem to have minds of their own. Nowhere is this more evident than in delays—interruptions between your actions and their consequences. Delays can make you badly overshoot your mark, or they can have a positive effect if you recognize them and work with them.

"One of the highest leverage points for improving system performance," says Ray Stata, CEO of Analog Devices, "is the minimization of system delays." Stata is referring to an increasing awareness on the part of American manufacturers that while they have worked traditionally to control tightly the amount of inventory in warehouses, their Japanese counterparts have concentrated on reducing delays—a much more successful effort. "The way leading companies manage time," says George Stalk, vice president of the Boston Consulting Group, "—in production, in new product development, in sales and distribution—represents the most powerful new source of competitive disadvantage."

Delays between actions and consequences are everywhere in human systems. We invest now to reap a benefit in the distant future; we hire a person today but it may be months before he or she is fully productive; we commit resources to a new project knowing that it will be years before it will pay off. But delays are often unappreciated and lead to instability. For example, the decision makers in the beer game consistently misjudged the delays that kept them from getting orders filled when they thought they would.

Delays, when the effect of one variable on another takes time, constitute the third basic building block for a systems language. Virtually all feedback processes have some form of delay. But often the delays are either unrecognized or not well understood. This can result in "overshoot," going further than needed to achieve a desired result. The delay between eating and feeling full has been the nemesis of many a happy diner; we don't yet feel full when we should stop eating, so we keep going until we are overstuffed. The delay between starting a new construction project and its completion results in overbuilding real estate markets and an eventual shakeout. In the beer game, the delay between placing and receiving orders for beer regularly results in overordering.

Unrecognized delays can also lead to instability and breakdown, especially when they are long. Adjusting the shower temperature,



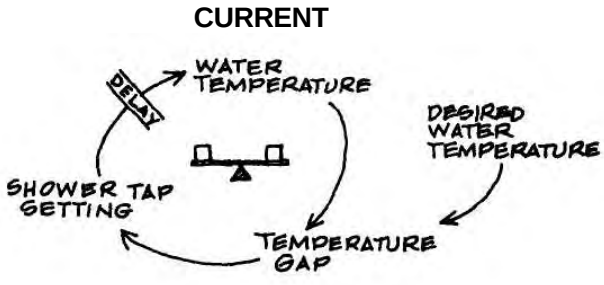
Balancing Process with a Delay: A Sluggish Shower

Here's our earlier "water faucet" feedback diagram again — but this time, with antiquated plumbing. Now there's a significant delay between the time you turn the faucet, and the time you see change in the water flow. Those two cross-hatch lines represent the delay.

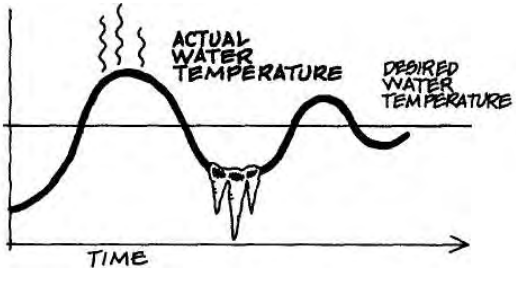
Arrows with cross-hatch lines don't tell you how many seconds (or years) the delay will last. You only know it's long enough to make a difference.

When you follow an arrow with a delay, add the word "eventually" to the story you tell in your mind. "I moved the faucet handle, which eventually changed the water flow." Or, "I began a new construction project and, eventually, the houses were ready." You may even want to skip a beat— "one, two"—as you talk through the process.

for instance, is far more difficult when there is a ten-second delay before the water temperature adjusts, then when the delay takes only a second or two.



During that ten seconds after you turn up the heat, the water remains cold. You receive no response to your action; so you *perceive* that your act has had no effect. You respond by continuing to turn up the heat. When the hot water finally arrives, a 190-degree water gusher erupts from the faucet. You jump out and turn it back; and, after another delay, it's frigid again. On and on you go, through the balancing loop process. Each cycle of adjustments compensates somewhat for the cycle before. A diagram would look like this:



The more aggressive you are in your behavior—the more drastically you turn the knobs—the longer it will take to reach the right temperature. That's one of the lessons of balancing loops with delays: that aggressive action often produces exactly the opposite of what is intended. It produces instability and oscillation, instead of moving you more quickly toward your goal.

Delays are no less problematic in reinforcing loops. In the arms race example, each side perceives itself as gaining advantage from

expanding its arsenal because of the delay in **the other side's re* sponse.** This delay can **be** as long as five years **because of the time** required to gather intelligence on the other side's weaponry, and to design and deploy new weapons. It is this temporary perceived advantage that keeps the escalation process going. If each side were able to respond instantly to buildups of its adversary, incentives to keep building would be nil.

The systems viewpoint is generally oriented toward the long-term view. That's why delays and feedback loops are so important. In the short term, you can often ignore them; they're inconsequential. They only come back to haunt you in the long term.

Reinforcing feedback, balancing feedback, and delays are all fairly simple. They come into their own as building blocks for the "systems archetypes"—more elaborate structures that recur in our personal and work lives again and again.

6

NATURE'S TEMPLATES: IDENTIFYING THE PATTERNS THAT CONTROL EVENTS

Some years ago, I witnessed a tragic accident while on an early spring canoe trip in Maine. We had come to a small dam, and put in to shore to portage around the obstacle. A second group arrived, and a young man who had been drinking decided to take his rubber raft over the dam. When the raft overturned after going over the dam, he was dumped into the freezing water. Unable to reach him, we watched in horror as he struggled desperately to swim downstream against the backwash at the base of the dam. His struggle lasted only a few minutes; then he died of hypothermia. Immediately, his limp body was sucked down into the swirling water. Seconds later, it popped up, ten yards downstream, free of the maelstrom at the base of the dam. What he had tried in vain to achieve in the last moments of his life, the currents accomplished for him within seconds after his death. Ironically, it was his very struggle against the forces at the base of the dam that killed him. He didn't know that the only way out was "counterintuitive. If he hadn't tried to keep his head above water, but instead dived down to where the current flowed downstream, he would have survived.

This tragic story illustrates the essence of the systems perspective, **first shown** in **the beer** game in Chapter 3, and again in the arms race at the beginning of Chapter 5. *Structures of which we are unaware hold us prisoner.* Conversely, learning to see the structures within which we operate begins a process of freeing ourselves from previously unseen forces and ultimately mastering the ability to work with them and change them.

One of the most important, and potentially most empowering, insights to come from the young field of systems thinking is that certain patterns of structure recur again and again. These "systems archetypes" or "generic structures" embody the key to learning to see structures in our personal and organizational Jives. The systems archetypes—of which there are only a relatively small number'—suggest that not all management problems are unique, something that experienced managers know intuitively.

If reinforcing and balancing feedback and delays are like the nouns and verbs of systems thinking, then the systems archetypes are analogous to basic sentences or simple stories that get retold again and again. Just as in literature there are common themes and recurring plot lines that get recast with different characters and settings, a relatively small number of these archetypes are common to a very large variety of management situations.

The systems archetypes reveal an elegant simplicity underlying the complexity of management issues. As we learn to recognize more and more of these archetypes, it becomes possible to see more and more places where there is leverage in facing difficult challenges, *and* to explain these opportunities to others.

As we learn more about the systems archetypes, they will no doubt contribute toward one of our most vexing problems, a problem against which managers and leaders struggle incessantly—specialization and the fractionation of knowledge. In many ways, the greatest promise of the systems perspective is the unification of knowledge across all fields—for these same archetypes recur in biology, psychology, and family therapy; in economics, political science, and ecology; as well as in management.[2]

Because they are subtle, when the archetypes arise in a family, an ecosystem, a news story, or a corporation, you often don't see them so much as feel them. Sometimes they produce a sense of *dejd vu,* a hunch that you've seen this pattern of forces before. "There it is again," you say *to* yourself. Though experienced managers already **know** many of these recurring plot lines intuitively, they often don't

know how to explain them. The systems archetypes provide that language. They can make explicit much of what otherwise is simply "management judgment."

Mastering the systems archetypes starts an organization on the path of putting the systems perspective into practice. It is not enough to espouse systems thinking, to say, "We must look at the big picture and take the long-term view." It is not enough to appreciate basic systems principles, as expressed in the laws of the fifth discipline (Chapter 4) or as revealed in simulations such as the beer game (Chapter 3). It is not even enough to see a particular structure underlying a particular problem (perhaps with the help of a consultant). *This can lead to solving a problem, but it will not change the thinking that produced the problem in the first place.* For learning organizations, only when managers start thinking in terms of the systems archetypes, does systems thinking become an active daily agent, continually revealing how we create our reality.

The purpose of the systems archetypes is to recondition our perceptions, so as to be more able to *see* structures at play, and to see the leverage in those structures. Once a systems archetype is identified, it will always suggest areas of high- and low-leverage change. Presently, researchers have identified about a dozen systems archetypes, nine of which are presented and used in this book (Appendix 2 contains a summary of the archetypes used here). All of the archetypes are made up of the systems building blocks: reinforcing processes, balancing processes, and delays. Below are two that recur frequently, and which are steppingstones to understanding other archetypes and more complex situations.

ARCHETYPE 1: LIMITS TO GROWTH

DEFINITION

A reinforcing (amplifying) process is set in motion to produce a desired result. It creates a spiral of success but also creates inadvertent secondary effects (manifested in a balancing process) which eventually slow down the success.

MANAGEMENT PRINCIPLE **Don't**

push growth; remove the factors limiting growth.

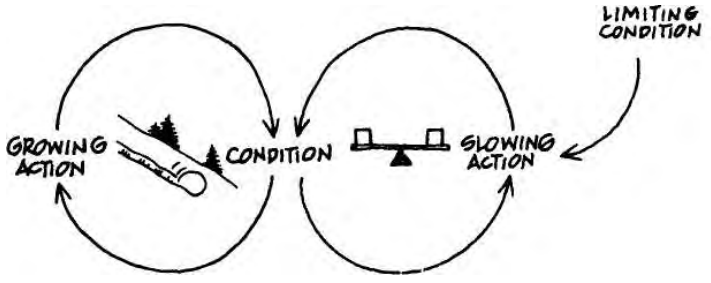
The limits to growth structure is useful for understanding all situations where growth bumps up against limits. For example, organizations grow for a while, but then stop growing. Working groups get better for a while, but stop getting better. Individuals improve themselves for a period of time, then plateau.

Many sudden but well-intentioned efforts for improvement bump up against limits to growth. A farmer increases his yield by adding fertilizer, until the crop grows larger than the rainfall of the region can sustain. A crash diet works at first to shave off a few pounds of fat, but then the dieter loses his or her resolve. We might "solve" sudden deadline pressures by working longer hours; eventually, however, the added stress and fatigue slow down our work speed and quality, compensating for the longer hours.

People who try to break a bad habit such as criticizing others frequently come up against limits to growth. At first, their efforts to stop criticizing pay off. They criticize less. The people around them feel more supported. The others reciprocate with positive feelings, which makes the person feel better and criticize less. This is a reinforcing spiral of improved behavior, positive feelings, and further improvement. But, then, their resolve weakens. Perhaps they start to find themselves facing the aspects in others' behavior that really gives them the most trouble: it was easy to overlook a few little things, but *this* is another matter. Perhaps, they just become complacent and stop paying as close attention to their knee-jerk criticisms. For whatever reason, before long, they are back to their old habits.

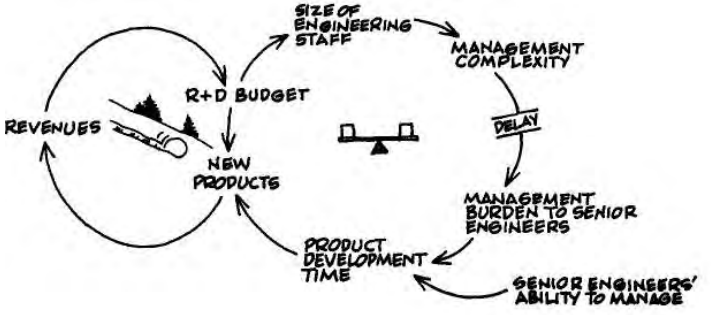
Once, in one of our seminars, a participant said, "Why, that's just like falling in love." Cautiously, I asked, "How so?" She responded, "Well, first, you meet. You spend a little time together and it's wonderful. So you spend more time together. And it's more wonderful. Before long, you're spending all your free time together. Then you get to know each other better. He doesn't always open the door for you, or isn't willing to give up bowling with his buddies—every other night. He discovers that you have a jealous streak, or a bad temper, or aren't very neat. Whatever it is, you start to see each other's shortcomings." As you learn each other's flaws, she reminded the rest of us, the dramatic growth in feelings comes to a sudden halt—and may even reverse itself, so that you feel worse about each other than you did when you first met.

In each case of limits to growth, there is a reinforcing (amplifying) **process of** growth or improvement that operates on its own for a **period** of time. Then it runs up against a balancing (or stabilizing) process, which operates to limit the growth. When that happens, the rate of improvement slows down, or even comes to a standstill.



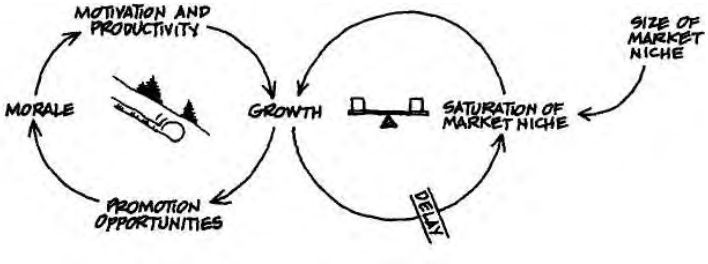
UNDERSTANDING AND USING THE STRUCTURE

Limits to growth structures operate in organizations at many levels. For example, a high-tech organization grows rapidly because of its ability to introduce new products. As new products grow, revenues grow, the R&D budget grows, and the engineering and research staff grows. Eventually, this burgeoning technical staff becomes increasingly complex and difficult to manage. The management burden often falls on senior engineers, who in turn have less time to spend on engineering. Diverting the most experienced engineers from engineering to management results in longer product development times, which slow down the introduction of new products.[3]



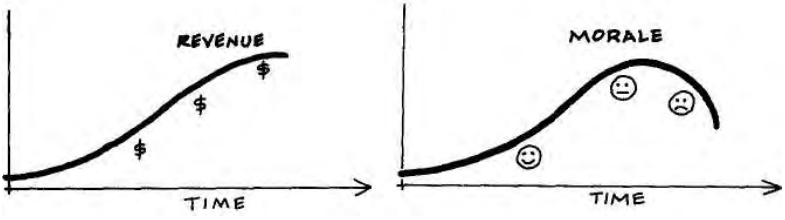
To read any "limits to growth" structure diagram, for example, **start with the** reinforcing circle of growth. That circle provides **the structure** with its initial momentum. Walk yourself around the circle: **remind** yourself how new product growth might generate revenues, which in turn can be reinvested to generate more new products. At some point, however, the forces will shift—here, for example, the growth in R&D budget eventually leads to complexity beyond the senior engineers' ability to manage without diverting precious time from product development. After a delay (whose length depends on the rate of growth, complexity of products, and engineers' management skills), new product introductions slow, slowing overall growth.

Another example of limits to growth occurs when a professional organization, such as a law firm or consultancy, grows very rapidly when it is small, providing outstanding promotion opportunities. Morale grows and talented junior members are highly motivated, expecting to become partners within ten years. But as the firm gets larger, its growth slows. Perhaps it starts to saturate its market niche. Or it might reach a size where the founding partners are no longer interested in sustaining rapid growth. However the growth rate slows, this means less promotion opportunities, more in-fighting among junior members, and an overall decline in morale. The limits to growth structure can be diagrammed as follows:[4]



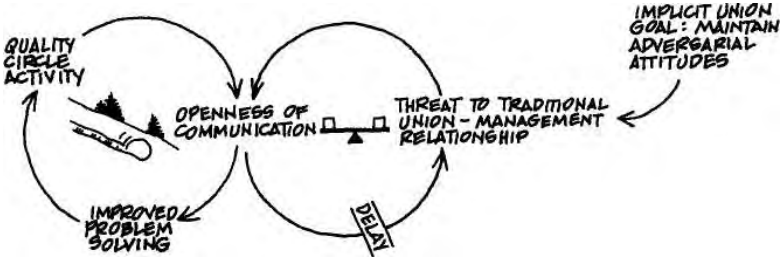
PATTERN OF BEHAVIOR

In each of these structures, the limit gradually becomes more powerful. After its initial boom, the growth mysteriously levels off. The technology company may never recapture its capabilities for developing breakthrough new products or generating rapid growth.



Eventually, growth may slow so much that the reinforcing spiral may turn around and run in reverse. The law firm or consulting firm loses its dominance in its market niche. Before long, morale in the firm has actually started on a downward spiral, caused by the reinforcing circle running in reverse.

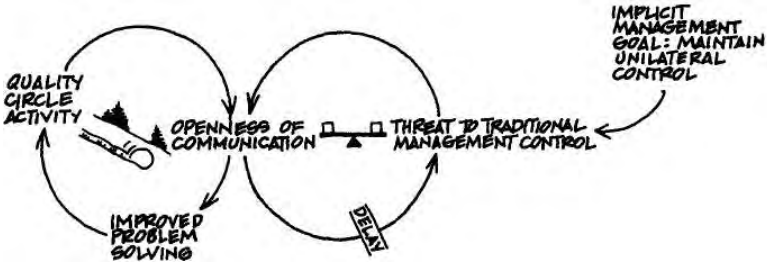
Limits to growth structures often frustrate organizational changes that seem to be gaining ground at first, then run out of steam. For example, many initial attempts to establish "quality circles" fail ultimately in U.S. firms, despite making some initial progress. Quality circle activity begins to lead to more open communication and collaborative problem solving, which builds enthusiasm for more quality circle activity. But the more successful the quality circles become, the more threatening they become to the traditional distribution of political power in the firm. Union leaders begin to fear that the new openness will break down traditional adversarial relations between workers and management, thereby undermining union leaders' ability to influence workers. They begin to undermine the quality



circle activity by playing on workers' apprehensions about being manipulated and "snowed" by managers: "Be careful; if you keep coming up with cost saving improvements on the production line, your job will be the next to go."[5]

Managers, on the other hand, are often unprepared to share control with workers whom they have mistrusted in the past. They end

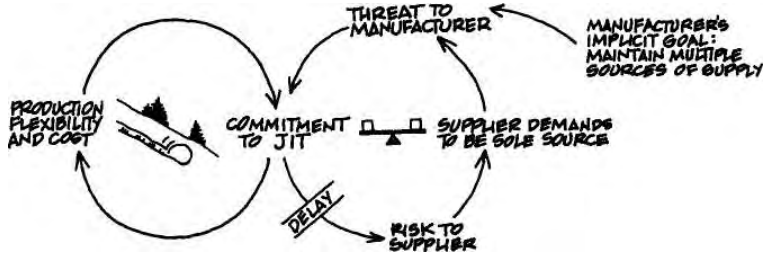
up participating in quality circle activities but only **going through the** motions. They graciously acknowledge workers' suggestions but fail to implement them.



Rather than achieving steady acceptance, quality circle activity rises for a time—then plateaus or declines. Often, the response of the leader to disappointing results from the quality circle simply feeds fuel to the flame. The more aggressively the leader promotes the quality circle, the more people feel threatened and the more stonewalling takes place.

You see similar dynamics with "Just in Time" inventory systems, which depend on new relationships of trust between suppliers and manufacturers. Initial improvements in production flexibility and cost are not sustained. Often, the supplier in a JIT system eventually demands to be a sole source to offset the risk in supplying the manufacturer overnight. This threatens the manufacturer, who is used to placing multiple orders with different suppliers to guarantee control of parts supply. The manufacturer's commitment to JIT then wavers.

The supplier's commitment to JIT can likewise waver, once he realizes that the manufacturer demands to be his prime customer. Used to having multiple customers, the supplier can't help but wonder whether the manufacturer will go on ordering parts from multiple



suppliers and then suddenly cancel orders. The more aggressively you try to change **the** process, the more aware both sides are of **their risks.** Thus, the more likely they are to hedge those risks by sticking **to** traditional practices of multiple suppliers and multiple customers, thereby undermining the trust a JIT system requires.[6]

HOW TO ACHIEVE LEVERAGE

Typically, most people react to limits to growth situations by trying to push hard: if you can't break your bad habit, become more diligent in monitoring your own behavior; if your relationship is having problems, spend more time together or work harder to make the relationship work; if staff are unhappy, keep promoting junior staff to make them happy; if the flow of new products is slowing down, start more new product initiatives to offset the problems with the ones that are bogged down; or advocate quality circle more strongly.

It's an understandable response. In the early stages when you can see improvement, you want to do more of the same—after all, it's working so well. When the rate of improvement slows down, you want to compensate by striving even harder. Unfortunately, the more vigorously you push the familiar levers, the more strongly the balancing process resists, and the more futile your efforts become. Sometimes, people just give up their original goal—lowering their goal to stop criticizing others, or giving up on their relationship, or giving up on quality circle or JIT improvements.

But there is another way to deal with limits to growth situations. *In each of them, leverage lies in the balancing loop—not the reinforcing loop. To change the behavior of the system, you must identify and change the limiting factor.* This may require actions you may not yet have considered, choices you never noticed, or difficult changes in rewards and norms. To reach your desired weight may be impossible by dieting alone—you need to speed up the body's metabolic rate, which may require aerobic exercise. Sustaining loving relationships requires giving up the ideal of the "perfect partner"— the implicit goal that limits the continued improvement of any relationship. Maintaining morale and productivity as a professional firm matures requires a different set of norms and rewards that salute work well done, not a person's place in the hierarchy. It may also require distributing challenging work assignments equitably and not to "partners only." Maintaining effective product development pro-

cesses as a firm grows requires dealing with the management burden brought on by an increasingly complex research and engineering organization. Some firms do this by decentralizing, some by bringing in professionals skilled in managing creative engineers (which is not easy), and some by management development for engineers who want to manage.

Not surprisingly, where quality circles have succeeded they have been part of a broader change in managerial-employee relationships. In particular, successes have involved genuine efforts to redistribute control, thereby dealing with the union and management concerns over loss of control. Likewise, successful Just in Time systems have taken root as part of "Total Quality" programs that focus on meeting customer needs, stabilizing production rates, and sharing benefits with valued suppliers. These changes were necessary to overcome the distrust that lay behind traditional goals of maintaining multiple sources of supply and multiple customers. In successful cases, managers had to ignore temptations to think that quality circle failures were due to individual troublemakers; or that JIT problems came from a recalcitrant supplier.[7]

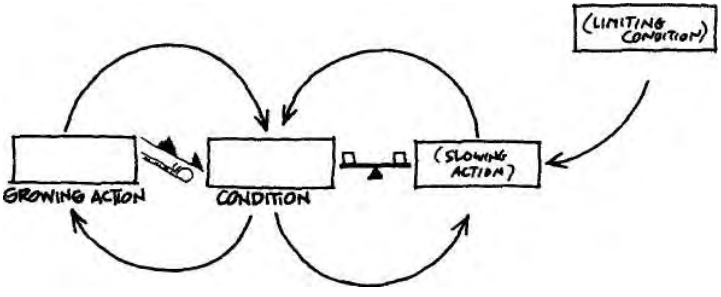
But there is another lesson from the limits to growth structure as well. There will always be more limiting processes. When one source of limitation is removed or made weaker, growth returns until a new source of limitation is encountered. In some settings, like the growth of a biological population, the fundamental lesson is that growth eventually *will* stop. Efforts to extend the growth by removing limits can actually be counterproductive, forestalling the eventual day of reckoning, which given the pace of change that reinforcing processes can create (remember the French lily pads) may be sooner than we think.

HOW TO CREATE YOUR OWN "LIMITS TO GROWTH" STORY

The best way to understand an archetype is to diagram your own version of it. The more actively you work with the archetypes, the better you will become at recognizing them and finding leverage.

Most people have many limits to growth structures in their lives. The easiest way to recognize them is through the pattern

of behavior. Is there a situation in which things get better and better at first, and then mysteriously stop improving? Once you have such a situation in mind, see if you can identify the appropriate elements of the reinforcing and balancing loops:[8]



First, identify the reinforcing process—what is getting better and what is the action of activity leading to improvement? (There may be other elements of the reinforcing process, but there are always at least a condition which is improving, and an action leading to the improvement.) It might, for instance, be the story of an organizational improvement: an equal opportunity hiring program, for example. The "growing action" is the equal opportunity program itself; and the condition is the percentage of women and minorities on staff. For example, as the percentage of women in management increases, confidence in or commitment to the program increases, leading to still further increase in women in management.

There is, however, bound to be a limiting factor, typically an implicit goal, or norm, or a limiting resource. The second step is to identify the limiting factor and the balancing process it creates. What "slowing action" or resisting force starts to come into play to keep the condition from continually improving? In this case, some managers might have an idea in their minds of how many women or minority executives are "too much." That unspoken number is the limiting factor; as soon as that threshold is approached, the slowing action—manager's resistance—will kick in. Not only will they resist more equal opportunity hires, but they may make life exceptionally difficult for the new people already in place.

Once you've mapped out your situation, look for the leverage. It won't involve pushing harder; that will just make the

resistance stronger. More likely, it will require weakening or removing the limiting condition.

For **the** best results, test your limits to growth story in real life. Talk to others about your perception. Test your ideas about leverage in small real-life experiments first. For example, you might seek out one person whom you perceive as holding an implicit quota for "enough women," but who is also approachable, and ask him. (See the reflection and inquiry skills section in Chapter 10, "Mental Models," for how to do this effectively.)

ARCHETYPE 2: SHIFTING THE BURDEN

DEFINITION

An underlying problem generates symptoms that demand attention. But the underlying problem is difficult for people to address, either because it is obscure or costly to confront. So people "shift the burden" of their problem to other solutions—well-intentioned, easy fixes which seem extremely efficient. Unfortunately, the easier "solutions" only ameliorate the symptoms; they leave the underlying problem unaltered. The underlying problem grows worse, unnoticed because the symptoms apparently clear up, and the system loses whatever abilities it had to solve the underlying problem.

MANAGEMENT PRINCIPLE

Beware the symptomatic solution. Solutions that address only the symptoms of a problem, not fundamental causes, tend to have short-term benefits at best. In the long term, the problem resurfaces and there is increased pressure for symptomatic response. Meanwhile, the capability for fundamental solutions can atrophy.

Shifting the burden structures are common in our personal as well as organizational lives. They come into play when there are obvious "symptoms of problems" that cry out for attention, and quick and ready "fixes" that can make these symptoms go away, at least for a while.

Consider the problem of stress that comes when our personal workload increases beyond our capabilities to deal with it effectively. We juggle work, family, and community in a never-ending blur of activity. If the workload increases beyond our capacity (which tends to happen for us all) the only fundamental solution is to limit the workload. This can be tough—it may mean passing up a promotion that will entail more travel. Or it may mean declining a position on the local school board. It means prioritizing and making choices. Instead, people are often tempted to juggle faster, relieving the stress with alcohol, drugs, or a more benign form of "stress reduction" (such as exercise or meditation). But, of course, drinking doesn't really solve the problem of overwork—it only masks the problem by temporarily relieving the stress. The problem comes back, and so does the need for drinking. Insidiously, the shifting the burden structure, if not interrupted, generates forces that are all-too-familiar in contemporary society. These are the dynamics of avoidance, the result of which is increasing dependency, and ultimately addiction.

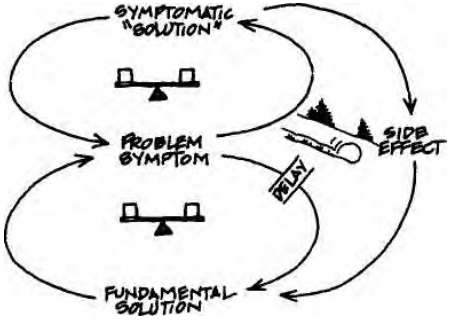
A shifting the burden structure lurks behind many "solutions" which seem to work effectively, but nonetheless leave you with an uneasy feeling that they haven't quite taken care of the problem. Managers may believe in delegating work to subordinates but still rely too much on their own ability to step in and "handle things" at the first sign of difficulty, so that the subordinate never gets the necessary experience to do the job. Businesses losing market share to foreign competitors may seek tariff protection and find themselves unable to operate without it. A Third World nation, unable to face difficult choices in limiting government expenditures in line with its tax revenues, finds itself generating deficits that are "financed" through printing money and inflation. Over time, inflation becomes a way of life, more and more government assistance is needed, and chronic deficits become accepted as inevitable. Shifting the burden structures also include food relief programs that "save" farmers

from having to grow crops, **and** pesticides **that temporarily remove vermin, but** also eliminate natural controls, making it easier for **the pest** to surge back in the future.

STRUCTURE

The shifting the burden is composed of two balancing (stabilizing) processes. Both are trying to adjust or correct the same problem symptom. The top circle represents the symptomatic intervention; the "quick fix." It solves the problem symptom quickly, but only temporarily. The bottom circle has a delay. It represents a more fundamental response to the problem, one whose effects take longer to become evident. However, the fundamental solution works far more effectively—it may be the only enduring way to deal with the problem.

Often (but not always), in shifting the burden structures there is also an additional reinforcing (amplifying) process created by "side effects" of the symptomatic solution. When this happens, the side effects often make it even more difficult to invoke the fundamental solution—for example, the side effects of drugs administered to correct a health problem. If the problem was caused originally by an unhealthy lifestyle (smoking, drinking, poor eating habits, lack of exercise), then the only fundamental solution lies in a change in lifestyle. The drugs (the symptomatic solution) make the symptom better, and remove pressure to make difficult personal changes. But they also have side effects that lead to still more health problems, making it even more difficult to develop a healthy lifestyle.

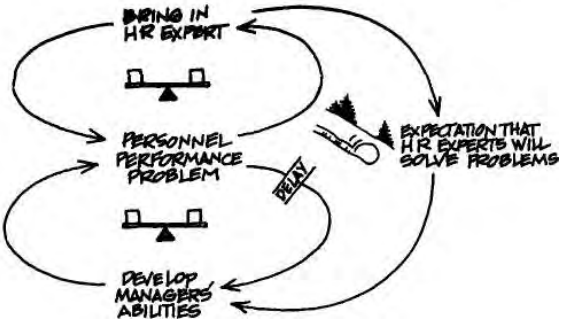


The shifting the burden structure explains a wide range of behaviors where well-intended "solutions" actually make matters worse over **the** long term. Opting for "symptomatic solutions" is enticing. Apparent improvement is achieved. Pressures, either external or internal, to "do something" about a vexing problem are relieved. But easing a problem symptom also reduces any perceived need to find more fundamental solutions. Meanwhile, the underlying problem remains unaddressed and may worsen, and the side effects of the symptomatic solution make it still harder to apply the fundamental solution. Over time, people rely more and more on the symptomatic solution, which is becoming increasingly the only solution. Without anyone making a conscious decision, people have "shifted the burden" to increasing reliance on symptomatic solutions.

Interactions between corporate staff and line managers are fraught with shifting the burden structures. For example, busy managers are often tempted to bring in human resource specialists to sort out personnel problems. The HR expert may solve the problem, but the manager's ability to solve other related problems has not improved. Eventually, other personnel issues will arise and the manager will be just as dependent on the HR expert as before. The very fact that the outside expert was used successfully before makes it even easier to turn to the expert again. "We had a new batch of difficulties, so we brought in the personnel specialists again. They are getting to know our people and our situation well, so they are very efficient." Over time, HR experts become increasingly in demand, staff costs soar, and managers' development (and respect) declines.

Shifting the burden structures often underlie unintended drifts in strategic direction and erosion in competitive position. A recent group of executives in a high-tech firm were deeply concerned that their company was "losing its edge" by not bringing dramatic new products to market. It was less risky to improve existing products. However, they feared that a culture of "incrementalism" rather than "breakthrough" was being fostered. The safer, more predictable, easier-to-plan-for-and-organize processes of improvement innovation were becoming so entrenched that the managers wondered if the company was still capable of basic innovation.

As I listened, I recalled a similar strategic drift described by managers of a leading consumer goods producer, which had become

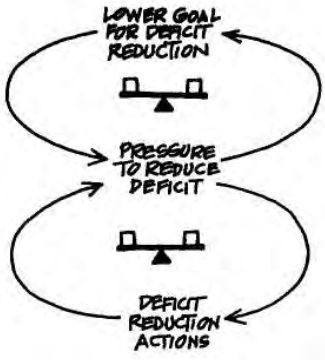


more and more dependent on advertising versus new product development. Whenever business sagged for one of its many products, the tendency was to run a new advertising promotion. The advertising culture had become so entrenched, that the last three CEOs were all ex-advertising executives, who frequently wrote ad copy personally. Meanwhile, the flow of major new products had dwindled to a trickle under their leadership.

A special case of shifting the burden, which recurs with alarming frequency, is "eroding goals." Whenever there is a gap between our goals and our current situation there are two sets of pressures: to improve the situation and to lower our goals. How these pressures are dealt with is central to the discipline of personal mastery, as will be shown in Chapter 9.

Societies collude in eroding goals all the time: witness the lowered standards for "full employment" in the United States. The federal full-employment target slid from 4 percent in the 1960s to 6 to 7 percent by the early 1980s. (In other words, we were willing to tolerate 50 to 75 percent more unemployment as "natural.") Likewise, 3 to 4 percent inflation was considered severe in the early 1960s, but a victory for anti-inflation policies by the early 1980s. In 1984, the U.S. Congress passed the "Gramm-Rudman-Hollings" deficit reduction bill. The original bill called for reaching a balanced budget by 1991. Shortly thereafter, it was clear that the budget reduction was not proceeding on pace, so the target was shifted to 1993. This eroding goal structure can be diagrammed as follows:

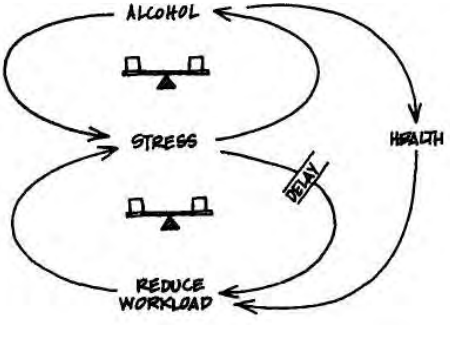
As we will see in the next two chapters, similar eroding goal dynamics play out in organizations around goals for quality, goals for innovation, goals for personal growth of employees, and goals for organizational improvement. In effect, we all can become "addicted" to lowering our goals. Or, as a bumper sticker I saw recently said, "If all else fails, lower your goals."



PATTERN OF BEHAVIOR

Regardless of the choice of symptomatic solution, it works—in a way. Drinking, for example, lifts some tension, at least for a while. It relieves the problem symptom. If it didn't, people wouldn't drink. But it also gives the person the feeling of having "solved the problem," thereby diverting attention from the fundamental problem—controlling the workload. Failing to take a stand may well cause the workload to gradually increase further, since most of us are continually besieged by more demands on our time than we can possibly respond to. Over time, the workload continues to build, the stress returns, and the pressure to drink increases.

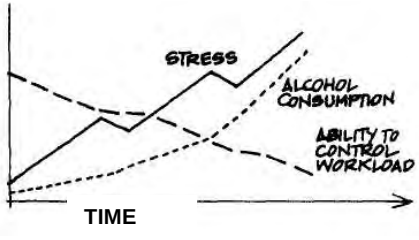
What makes the shifting the burden structure insidious is the subtle reinforcing cycle it fosters, increasing dependence on the symptomatic solution. Alcoholics eventually find themselves physically



addicted. Their health deteriorates. As their **self-confidence and judgment** atrophy, they are less and less able to solve their original workload problem. To trace out the causes of the reinforcing cycle, just imagine you are moving around the "figure eight" created by the two interacting feedback processes: stress builds, which leads to more alcohol, which relieves stress, which leads to less perceived need to adjust workload, which leads to more workload, which leads to more stress.

These are the generic dynamics of addiction. In fact, almost all forms of addiction have shifting the burden structures underlying them. All involve opting for symptomatic solutions, the gradual atrophy of the ability to focus on fundamental solutions, and the increasing reliance on symptomatic solutions. By this definition, organizations and entire societies are subject to addiction as much as are individuals.

Shifting the burden structures tend to produce periodic crises, when the symptoms of stress surface. The crises are usually resolved with more of the symptomatic solution, causing the symptoms to temporarily improve. What is often less evident is a slow, long-term drift to lower levels of health: financial health for the corporation or physical health for the individual. The problem symptom grows worse and worse. The longer the deterioration goes unnoticed, or the longer people wait to confront the fundamental causes, the more difficult it can be to reverse the situation. While the fundamental response loses power, the symptomatic response grows stronger and stronger.



HOW TO ACHIEVE LEVERAGE

Dealing effectively with shifting the burden structures requires a combination of strengthening the fundamental response and weakening the symptomatic response. The character of organizations is often revealed in their ability (or inability) to face shifting-the-burden structures. Strengthening fundamental responses almost always re-

quires a long-term orientation and a sense of shared vision. Without a vision of succeeding through new product innovation, pressures to divert investment into short-term problem-solving will be overwhelming. Without a vision of skilled "people-oriented" managers, the time and energy to develop those skills will not be forthcoming. Without a shared vision of the role government can and should play, and for which people will provide tax revenues to support, there can be no long-term solution to balance government spending and income.

Weakening the symptomatic response requires willingness to tell the truth about palliatives and "looking good" solutions. Managers might acknowledge, for example, that heavy advertising "steals" market share from competitors, but doesn't expand the market in any significant way. And politicians must admit that the resistance they face to raising taxes comes from the perception that the government is corrupt. Until they deal credibly with perceived corruption, they will neither be able to raise taxes nor reduce spending.

A splendid illustration of the principles of leverage in shifting the burden structures can be found in the approach of some of the most effective alcoholism and drug treatment programs. They insist that people face their addiction on one hand, while offering support groups and training to help them rehabilitate on the other. For example, the highly successful Alcoholics Anonymous creates powerful peer support to help people revitalize their ability to face whatever problems were driving them to drink, with a sense of vision that those problems can be solved. They also force individuals to acknowledge that "I am addicted to alcohol and will be for my entire life," so that the symptomatic solution can no longer function in secret.[9]

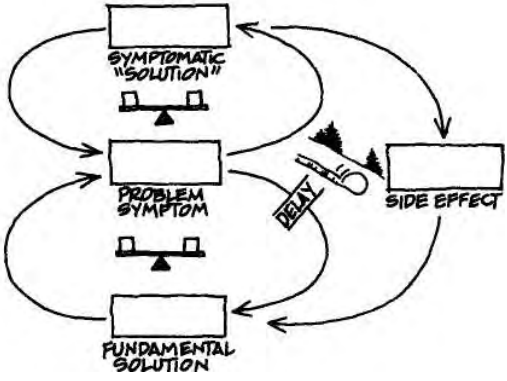
In the business example of managers becoming more and more dependent on HR consultants, the managers' own abilities must be developed more strongly, even though that may mean a larger initial investment. The HR experts must become coaches and mentors, not problem solvers, helping managers develop their own personal skills.

Sometimes symptomatic solutions *are* needed—for example, in treating a person suffering from a disease created by smoking or drinking. But symptomatic solutions must always be acknowledged as such, *and* combined with strategies for rehabilitating the capacity for fundamental solution, if the shifting the burden dynamic is to be interrupted. If symptomatic solutions are employed *as if* they are fundamental solutions, the search for fundamental solutions stops and shifting the burden sets in.

HOW TO CREATE YOUR OWN "SHIFTING THE BURDEN" STORY

There are three clues to the presence of a shifting the burden structure. First, there's a problem that gets gradually worse over the long term—although every so often it seems to get better for a while. Second, the overall health of the system gradually worsens. Third, there's a growing feeling of helplessness. People start out feeling euphoric—they've solved their problem!—but end up feeling as if they are victims.

In particular, look for situations of dependency, in which you have a sense that the real issues, the deeper issues, are never quite dealt with effectively. Again, once you have such a situation in mind, see if you can identify the appropriate elements of the reinforcing and balancing loops.



Start by identifying the "problem symptom." This will be the "squeaky wheel" that demands attention—such as stress, subordinates' inabilities to solve pressing problems, falling market share. Then identify a "fundamental solution" (there may be more than one)—a course of action that would, you believe, lead to enduring improvement. Then, identify one or several "symptomatic solutions" that might ameliorate symptoms for a time.

In fact, "fundamental solutions" and "symptomatic solutions" are relative terms, and what is most valuable is recog-

nizing the multiple ways **in** which a problem can be addressed, from **the** most fundamental to the most superficial.

Then identify the possible negative "side effects" of the symptomatic solution.

The primary insights in shifting the burden will come from (1) distinguishing different types of solutions; (2) seeing how reliance on symptomatic solutions can reinforce further reliance. The leverage will always involve strengthening the bottom circle, and/or weakening the top circle. Just as with limits to growth, it's best to test your conclusions here with small

Limits to growth and shifting the burden are but two of the basic systems archetypes. Several others are introduced in the following chapters. (Appendix 2 summarizes all the archetypes used in this book.) As the archetypes are mastered, they become combined into more elaborate systemic descriptions. The basic "sentences" become parts of paragraphs. The simple stories become integrated into more involved stories, with multiple themes, many characters, and more complex plots.

But the archetypes start the process of mastering systems thinking. By using the archetypes, we start to *see* more and more of the circles of causality that surround our daily activity. Over time, this leads naturally to thinking and acting more systemically.

To see how the archetypes get put into practice, the next chapter examines one way in which limits to growth and shifting the burden have proven useful—in understanding the ways a company with great growth potential can fail to realize that potential.

7

THE PRINCIPLE OF LEVERAGE

To me, bottom line of systems thinking is leverage—seeing where actions and changes in structures can lead to significant, enduring improvements. Often, leverage, follows the principle of economy of means: where the best results come not from large-scale efforts but from small well-focused actions. Our nonsystemic ways of thinking are so damaging specifically because they consistently lead us to focus on low-leverage changes: we focus on symptoms where the stress is greatest. We repair or ameliorate the symptoms. But such efforts only make matters better in the short run, at best, and worse in the long run.

It's hard to disagree with the *principle* of leverage. But the leverage in most real-life systems, such as most organizations, is not obvious to most of the actors in those systems. They don't see the "structures" underlying their actions. The purpose of the systems archetypes, such as limits to growth and shifting the burden, is to help see those structures and thus find the leverage, especially amid the pressures and crosscurrents of real-life business situations.

For example, let's look at a real story that we have seen again and again. In fact, the following case is a mosaic **pieced together from several** specific instances where the same story unfolded.[1]

WHEN WE CREATE OUR OWN "MARKET LIMITATIONS"

In the mid-1960s a new electronics company was founded with a unique high-tech product—a new type of computer. Thanks to its engineering know-how, WonderTech had a virtual lock on its market niche. There was enormous demand for its products, and there were enough investors to guarantee no financial constraints.

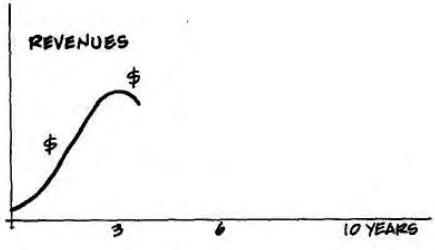
Yet the company, which began with meteoric growth, never sustained its rapid growth after its first three years. Eventually it declined into bankruptcy.

That fate would have seemed unthinkable during WonderTech's first three years, when sales doubled annually. In fact, sales were so good that backlogs of orders began to pile up midway through their second year. Even with steadily increasing manufacturing capacity (more factories, more shifts, more advanced technology), the demand grew so fast that delivery times slipped a bit. Originally they had promised to deliver machines within eight weeks, and they intended to return to that standard; but with some pride, the top management told investors, "Our computers are so good that some customers are willing to wait fourteen weeks for them. We know it's a problem, and we're working to fix it, but nonetheless they're *still* glad to get the machines, and they love 'em when they get 'em."

The top management knew that they had to add production capacity. After six months of study, while manufacturing changed from a one-shift to a two-shift operation, they decided to borrow the money to build a new factory. To make sure the growth kept up, they pumped much of the incoming revenue directly back into sales and marketing. Since the company sold its products only through a direct sales force, that meant hiring and training more sales people. During the company's third year, the sales force doubled.

But despite this, sales started to slump at the end of the third year.

By the middle of the fourth year, sales had dropped off to crisis levels. The curve of sales, so far, looked like this:



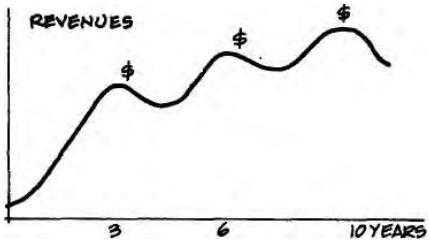
At this point, the new factory came on-line. "We've hired all these people," said the vice president of manufacturing. "What are we going to do with them?" The top management began to panic about what to tell their investors, after they had spent all this money on a new manufacturing facility. It was as if everyone in the company simultaneously turned and looked at one person: the marketing and sales vice president.

Not surprisingly, the marketing and sales VP had become a rising star in the company. His force had done so well during the initial boom that he had anticipated a promotion. Now there was a slump, and he was under heat to turn sales around. So he took the most likely course of action. He held high-powered sales meetings with a single message: *"Sell!* Sell! Sell!" He fired the low performers. He increased sales incentives, added special discounts, and ran new advertising promotions describing the machine in an exciting new way.

And indeed, sales rose again. The sales and marketing VP found himself once more hailed as a hero, a born-again motivator who could take charge of a tough situation. Once again, WonderTech was in the happy position of having rapidly rising orders. Eventually, backlogs began to grow again. And after a year, delivery times began to rise again—first to ten weeks, then to twelve, and eventually to sixteen. The debate over adding capacity started anew. But this time, having been stung on the last occasion, the top management was still more cautious. Eventually, approval of a new facility was granted, but no sooner had the papers been signed than a new sales crisis started. The slump was so bad that the sales and marketing vice president lost his job.

Over the next several years, and through a succession of marketing managers, the same situation recurred. High sales growth oc-

curred in spurts, always followed by periods of low or **no growth. The** pattern looked like this:



The company prospered modestly, but never came close to fulfilling its original potential. Gradually, the top managers began to fear that other firms would learn how to produce competing products. They frantically introduced ill-conceived improvements in the product. They continued to push hard on marketing. But sales never returned to the original rate of growth. The "wonder" went out of WonderTech. Eventually, the company collapsed.

In his final statement to the lingering members of his executive team, the CEO said, "We did great under the circumstances, but the demand just isn't there. Clearly it was a limited market—a niche which we have effectively filled."

The tale of WonderTech is hardly a novel one. Of every ten startup companies, one half will disappear within their first five years, only four survive into their tenth year, and only three into their fifteenth year.[2] Whenever a company fails, people always point to specific events to explain the "causes" of the failure: product problems, inept managers, loss of key people, unexpectedly aggressive competition, or business downturns. Yet, the deeper systemic causes for unsustained growth are not recognized. With the aid of the systems archetypes, these causes often can be understood and, in many cases, successful policies can be formulated. The irony of WonderTech is that, given its product and its market potential, it could have grown vigorously for many years, not just two or three.

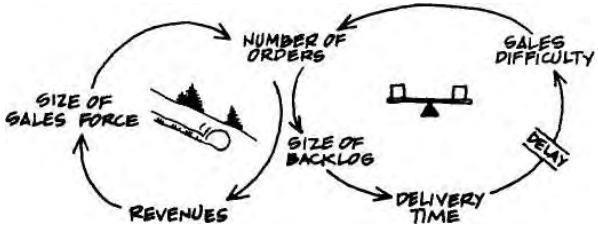
WonderTech's managers could not see the reasons for their own decline. This was not for lack of information. They had all the significant facts—the same facts that you have after reading this story. But they could not see the structures implicit in those facts.

As a systems thinker trying to diagnose WonderTech's problem, you would look for clues—anything that might suggest an archetype.

You'd begin with the most obvious pattern **ofiPPbr.** growth **leaped** up at first, amplifying itself to grow stronger and stronger. **But the growth gradually** slowed, and eventually **sales stopped growing altogether.** This pattern is the classic symptom of limits to **growth.**

There are many possible reinforcing (amplifying) processes that could have produced WonderTech's original rapid sales growth. Investment in products, investment in advertising, good word of mouth —all could have reinforced past success into future success. But one especially evident in the WonderTech story was the reinforcing process created by investing revenues in increasing the sales force: more sales meant more revenues, which meant hiring salespeople, which meant more sales.

The other part of any limits to growth structure, of course, is a balancing (stabilizing) process. Something had to make the sales slow down. But sales only slow down when a market is saturated, when competition grows, or when customers grow disenchanted. In this case, the need for the WonderTech computer was still strong, and there was no significant competition. There was one factor which turned customers off: long delivery times. As backlogs rise relative to production capacity, delivery times increase. A reputation for poor delivery service builds, eventually making it harder for WonderTech's salespeople to make more sales. The limits to growth structure, then, looks like this:



In a limits to growth structure, the worst thing you can do is push hard on the reinforcing process. But that's exactly what WonderTech's **managers did.** They tried to reignite the "engine of growth" **through** sales incentives, marketing promotions, and minor product improvements—none of which had any leverage. The leverage would lie with the balancing process.

Why wasn't that balancing process noticed? First, WonderTech's financially oriented top management did not pay much attention to their delivery service. They mainly tracked sales, profits, return on investment, and market share. So long as these were healthy, delivery times were the least of their concerns. When financial performance weakened, pressures shifted to boost orders. Usually, by this time, delivery times were already starting to come down because orders were falling. Thus, whether times were good, or times were bad, the top management paid little attention to the time customers had to wait to get their computers.

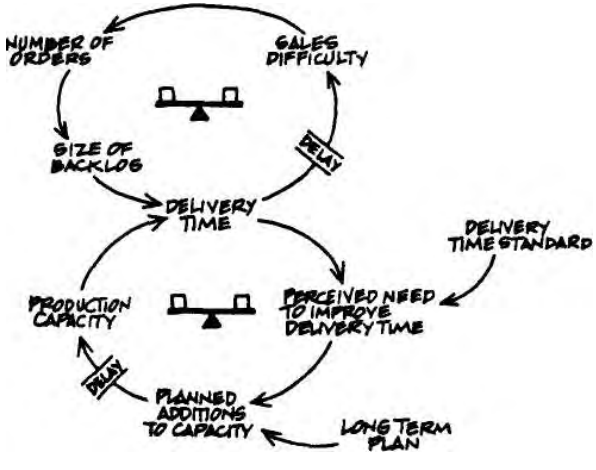
Even if they had, they would not necessarily have seen delivery time as a key factor affecting sales. Delivery times had been getting longer and longer, for more than a year and a half, before the first sales crisis hit. This reinforced an attitude among top management: "Customers don't care about late shipments." But that complacency was misplaced; customers *were* concerned, but their concern was obscured, to WonderTech's management, by a built-in delay in the system. A customer would say, "I want the machine delivered in eight weeks." The salesperson would say fine. But after nine, ten, or twelve weeks, there would still be no machine. After several more months, gossip would filter out. However, the number of potential customers was vast. And the gossip had little effect until it eventually mushroomed into a widespread reputation for poor deliveries. In the chart above, this delay falls in the arrow between Delivery Time and Sales Difficulty.

WonderTech's managers had fallen prey to the classic learning disability of being unable to detect cause and effect which were separated in time. In general, if you wait until demand falls off, and *then* get concerned about delivery time, it's way too late. The slow delivery time has already begun to correct itself—temporarily. At WonderTech, delivery times grew worse during the third year, the last year of rapid growth. Then they improved during the downturn that followed; but then they grew worse again.

Over the entire ten-year history of the firm, there was an unfortunate trend of rising delivery times, interrupted by periodic improve-

ments. Alongside that was a gradual decline in the **overall** health of **the** system—as seen in slowing growth and declining profits. The company made money in spurts, but lost money like mad in every downturn. The euphoria of the early growth period gave way to discouragement and, eventually, despair. People felt, at the end, as if they were victims. While the CEO said publicly that they had done **great** under the circumstances, privately he acknowledged that they had been misled by initial marketing projections that forecast a huge potential market that was never realized.

What no one realized was that the situation at WonderTech described a classic shifting the burden structure. There was a problem symptom (delivery time) that worsened steadily, albeit with periodic improvements. The overall health of the enterprise was also steadily worsening, and there was a growing feeling of victimization. As a systems thinker, you would first identify that key problem symptom, and then the symptomatic and fundamental responses to it. In this case, the fundamental response (the lower circle in the diagram below) is to expand production capacity to control delivery time. Delivery times above WonderTech's standard indicate the need for more capacity, which once it eventually arrives on-line, will correct long delivery times. But if this fundamental response is slow in coming, the burden shifts to the symptomatic response (the upper circle) of customer dissatisfaction in declining orders. Since WonderTech's managers didn't solve the problem of long delivery times by adding manufacturing capacity rapidly enough, disgruntled would-be customers "solved" the problem by walking away.



Moreover, as WonderTech allowed the "disgruntled customer" process to operate, the symptomatic response tended to get stronger and stronger—just as you'd expect from a shifting the burden structure. This occurred as WonderTech's reputation for poor delivery service spread through its market; whenever WonderTech entered a new period of rising delivery times, word spread more and more rapidly. Meanwhile, the fundamental response grew weaker. "Having been stung" when they added capacity that was left idle by falling orders, WonderTech's top management grew increasingly cautious in committing to new capacity additions. That meant that new capacity took longer and longer to come on-line—or never came on-line at all. By the time WonderTech's managers were finally ready to add capacity, the symptomatic response had already relieved the pressure, and delivery times had started to fall. Thus their long-term plan for building capacity apparently failed them each time. "Let's wait a little longer before building," they said, "to make sure the demand is there."

In effect, there was a horserace going on between the two responses. Over time, the symptomatic response became more rapid, while the fundamental response became more sluggish. The net effect was that gradually the "disgruntled customer" response assumed more and more of the burden for controlling delivery times.

As delivery times steadily worsened, WonderTech's customer base evolved toward customers who were less sensitive to poor delivery service. That meant they were more sensitive to price. Such customers are less loyal and easily lured away by competitors offering lower prices. WonderTech was drifting into the vulnerable position of being a low-quality, low-price supplier, in a market which they had pioneered.

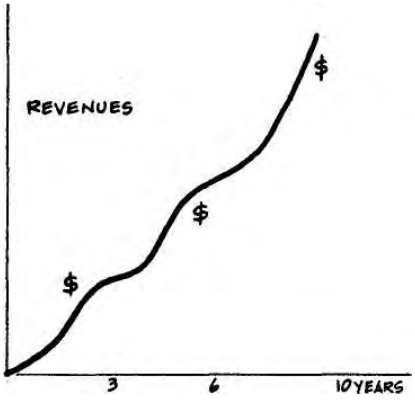
WonderTech's fate could have been reversed. There was a point of leverage in the structure: the firms' original commitment to an eight-week delivery time. In the shifting the burden structure, the first thing a systems thinker looks for is what might be weakening the fundamental response. In this case, the firm had a *delivery time standard*—eight weeks—that obviously never meant a great deal to the financially preoccupied top managers.

After three years, the actual operating standard to which manufacturing had become accustomed was about ten weeks. Over time, as delivery problems returned, the standard continued to drift. No one thought much about it, least of all top management. When they

wanted to know if additional capacity was **need, they would** check with manufacturing, which reinforced the eroding **standard** throughout the organization.

As it happened, the *second* marketing and sales vice president **periodically relayed** his customers' dissatisfaction with poor deliveries to the management team. His counterpart in manufacturing acknowledged that they occasionally got behind their backlogs, but **only** when their capacity was inadequate. But the top managers said, "Yes, we know it's a problem, but we can't rush into major invest- ,| ments unless we're certain demand will be sustained." They didn't realize that demand would never be sustained until they made the investment.

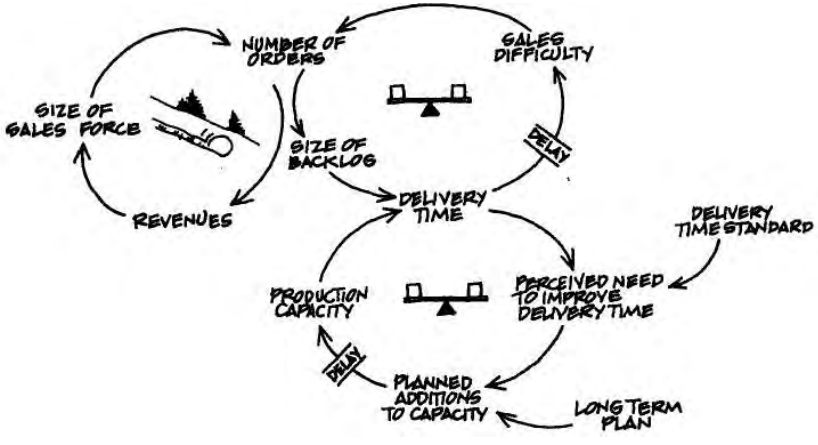
We will never know for certain what might have happened if the company had held tight to its original goal and continued to invest aggressively in manufacturing capacity. But simulations based on this structure (combining limits to growth and shifting the burden) and on actual sales figures have been conducted in which the delivery time standard is not allowed to erode. In these simulations, sales continue to grow rapidly throughout the ten years, although there are still periodic plateaus. Delivery time fluctuates, but does not drift upward and the delivery time standard is constant at eight weeks. WonderTech now realizes its growth potential. At the end of the ten years, sales are many times higher than in the original case.[3]



The original sales and marketing vice president had grasped these problems intuitively. He argued from the outset that WonderTech was assessing its factory capacity all wrong. "We only compare

capacity to the number of orders we *have,"* he said, "instead of the potential volume of orders that we *would* have if we were operating **at our** best." Unfortunately, the VP's arguments were interpreted as excuses for poor sales performance, and his insights went unheeded. It didn't help that he had no way, conceptually, to explain his thinking. Had he been able to describe the systems archetypes, perhaps more people would have grasped what seemed intuitive to him.

In fact, the subtle dynamics of WonderTech confirm an intuition of many experienced managers: that it is vital to hold to critical performance standards "through thick and thin," and to do whatever it takes to meet those standards. The standards that are most important are those that matter the most to the customer. They usually include product quality (design and manufacture), delivery service, service reliability and quality, and friendliness and concern of service personnel. The systemic structure at WonderTech converts this management intuition into an explicit theory, which shows how eroding standards and sluggish capacity expansion can undermine the growth of an entire enterprise. The complete structure comes from integrating limits to growth and shifting the burden:



As shown here, the two structures overlap, sharing one balancing process—where disgruntled customers reduce their orders due to long delivery times. The same balancing circle that diverts attention from adding capacity (in shifting the burden) also keeps sales from expanding (in limits to growth). Whether the "disgruntled customer"

circle becomes dominant depends on how the firm responds when delivery times are long. If standards are allowed to drift, the firm's response is weakened and "the burden shifts" to the disgruntled customers. In other words, the company unwittingly becomes addicted to the limiting of its own growth.

CHOOSING BETWEEN SELF-LIMITING OR SELF-SUSTAINING GROWTH

The systemic structure underlying WonderTech explains many complex situations where companies that were once growing rapidly and were highly successful fail mysteriously. In fact, this structure is another systems archetype called growth and underinvestment, a bit more complicated than the two previous archetypes. This archetype operates whenever a company limits its own growth through underinvestment. Underinvestment means building less capacity than is really needed to serve rising customer demand. You can recognize growth and underinvestment by the failure of a firm to achieve its potential growth despite everyone's working tremendously hard (a sign of the underinvestment). Usually, there is continuing financial stress—which, ironically, is both cause and consequence of underinvestment. Financial stress makes aggressive investment difficult or impossible, but the financial stress today originates in the underinvestment of the past. If you look closely, you will also see eroding or declining standards, within the company or industry, for "quality." (By quality we mean all the things that matter to a customer, such as product quality, service quality, and delivery reliability). Standards erode, or fail to continually advance with competition, which results in a failure to invest in building capacity to serve customer needs. ("Investing" may mean adding or improving physical capacity, training personnel, improving work processes, or improving organizational structures.) Disgruntled customers then go elsewhere. Or, if there is no elsewhere, as in the case of eroding standards in an entire industry, customers stop asking for what they can't have. Reduced customer demand eliminates the symptoms of unmet demand. It also reduces financial resources to invest in more capacity.

If all this happened in a month, the whole organization or industry would be mobilized to prevent it. It is the gradualness of the eroding

goals and declining growth that makes the dynamics of this structure so insidious. This is the structure that underlies the "boiled frog" syndrome discussed in the learning disabilities of Chapter 2. The **frog's** standards for water temperature steadily erode, and its capacity to respond to the threat of boiling atrophies.

For a single firm such as WonderTech, the result is a slow, steady decline in market share and profitability. For an entire industry, the result is increasing vulnerability to foreign competitors with higher standards, happening so slowly that it's difficult to detect, often masked by "shifting the burden" palliatives such as increased advertising, discounting, "restructuring," or lobbying for tariff protection. In my opinion, the dynamics of eroding goals and underinvestment lie at the heart of the demise, between the mid-1960s and mid-1980s, of many American manufacturing industries, such as steel autos, machine tools, and consumer electronics. In each of these industries, loss of market share to foreign competitors, which was invariably blamed on external factors, had its origins, at least in part, in weak standards for customer satisfaction, underinvestment, and unhappy customers.

There are many examples of growth and underinvestment in service industries as well. Schools which let the quality of their courses slip, until they lose accreditation. Hospitals whose reputation for patient care erodes as old facilities are not upgraded and the staff becomes increasingly overworked. Radio and television stations that cut their reporting budgets and let "happy talk" substitute for in-depth news coverage. One such prominent industry example will be examined in the next chapter—the case of People Express Airlines.

When understood, the growth and underinvestment structure can be a powerful guide for a company trying to create its own future. Jay Forrester tells an interesting story from the early days of the Digital Equipment Corporation. The company started operations in a corner of one floor of an old mill building outside Boston, with about a dozen employees. As a member of Digital's Board of Directors (Digital was founded by several of Forrester's former MIT graduate students), Forrester later persuaded the board to rent the whole football-field-sized floor as soon as the space became available. But that leap in capacity, which seemed outrageous at first, allowed Digital to grow without eroding its standards. A most dramatic experience, Forrester said later, was to come back only six months later and find the entire floor full of people, productively employed. This episode was one of the first for a company that has achieved one of

the finest records **of** sustained growth in **corporate history.** For years, Digital maintained a land bank of lots all over New England, **so that it had land ready when** it wanted to add capacity.

The art of systems thinking lies in being able to recognize increasingly (dynamically) complex and subtle structures, such as that at WonderTech amid the wealth of details, pressures, and cross currents that attend all real management settings. In fact, the essence of mastering systems thinking as a management discipline lies in seeing patterns where others see only events and forces to react to. Seeing the forest as well as the trees is a fundamental problem that plagues all firms, as is illustrated in the next chapter.

8

THE ART OF SEEING THE FOREST *AND* THE TREES

Of all recent U.S. presidents, probably none immersed himself so deeply in the issues facing the nation than Jimmy Carter. Yet, President Carter was widely seen as a relatively ineffective leader, leaving office with a 22 percent approval rating, the lowest of any president since the end of World II, including Richard Nixon.'

Jimmy Carter was a victim of complexity. Carter's thirst to know about issues firsthand left him drowning in details, without a clear perspective on those details. But, in fact, was Carter really that different from most contemporary leaders, in either the public or private sector? How many CEOs today can stand and give a fifteen-minute speech that lays out a compelling explanation of the systemic causes of an important issue, and the high- and low-leverage strategies for dealing with that issue?

We all know the metaphor of being able to "step back" far enough from the details to "see the forest for the trees." But, unfortunately, for most of us when we step back we just see "lots of trees." We pick our favorite one or two and focus our attention and efforts for change on those.

Systems thinking finds it greatest benefits in **helping us** distinguish **high-** from low-leverage changes in highly complex situations. In **effect, the** art of systems thinking lies in seeing *through* complexity **to the** underlying structures generating change. Systems thinking **does** not mean ignoring complexity. Rather, it means organizing complexity into a coherent story that illuminates the causes of problems and how they can be remedied in enduring ways. The increasing complexity of today's world leads many managers to assume that they lack information they need to act effectively. I would suggest that the fundamental "information problem" faced by managers is not too little information but too much information. What we most need are ways to know what is important and what is not important, what variables to focus on and which to pay less attention to—and we need ways to do this which can help groups or teams develop shared understanding.

THE PERILS OF BEING A PIONEER

One of the most spectacular and regrettable rises and falls of a prototype learning organization was People Express Airlines.[2] It is a parable of complexity that could not be disentangled in time to save the organization. Founded in 1980 to provide low-cost, high-quality airline service to travelers in the Eastern United States, People Express grew in five years to be the nation's fifth-largest carrier. Along the way, People Express established a reputation as a corporate pioneer, crafting a stirring corporate philosophy articulated by charismatic founder Don Burr. "Most organizations believe that humans are generally bad and you have to control them and watch them," said Burr in one typical statement. "At People Express, people are trusted to do a good job until they prove they definitely won't . . ."[3] The airline translated that philosophy into a host of innovative human resource policies that have since been adopted by many other firms, such as job rotation, team management, universal stock ownership, and only four levels of hierarchy (with only four pay levels in the whole company). Yet, despite its spectacular early success, in September 1986 People Express was taken over by Texas Air Corporation, having lost $133 million in the first six months of 1986 alone. Many theories have been offered to explain People's growth and

collapse. Burr and the airline had gained much public attention for unusually "soft," people-oriented management policies. Hard-headed business analysts felt that People's decline proved that "business is business." Lofty ideals and democratic workplaces conflict with profits, they said. Others blamed Burr and his management team for failing to provide ongoing strategic leadership—especially after the purchase of Denver-based Frontier Airlines in 1985, which brought in four thousand new employees who shared neither People's values nor its business strategy.

Some of People's own executives, including Burr himself, offer a different explanation. In 1984, partly in response to the success of low-cost carriers such as People Express, American Airlines introduced its Sabre seat-reservation computer system, ushering in a new era of "load management"—meaning that airlines could offer a limited number of seats at much-reduced prices, while still booking business passengers and others at full coach. It was a dramatic change in the airline business, and it brought People Express up against significant price competition for the first time.

It is no wonder that People Express poses such a puzzle. Understanding what went wrong requires sorting out an enormously complex set of factors such as:

FLEET	HUMAN RESOURCES	COMPETITIVE FACTORS
Planes	Service personnel	Market size Market
Capacity of aircraft	Aircraft personnel	segments Reputation
Routes	Maintenance	Service quality
Scheduled flights	personnel Hiring	Competitor service
Competitor routes	Training Turnover	quality
& flights Service	Morale	Fares
hours per	Productivity	"Load
plane (per day)	Experience Team	management"
Fuel efficiency	management Job	Competitor fares
	rotation Stock	
	ownership	
	Temporaries	

FINANCIAL VARIABLES	"POLICY LEVERS" *(A few of the key decisions that People's management must make)*
Revenues	
Profit	
Cost of plane operations	Buying planes
Cost of service operations	Hiring people
Cost of marketing	Pricing
Wages	Marketing expenditures
Stock price	"Service scope" (range of services to offer)
Growth rate	
Debt	
Interest Rate	

Such "laundry lists" of important variables hint at the enormous detail complexity of realistic management problems. It's easy to get lost in the "trees" of these details and lose sight of the "forest"—mastering the dynamic complexity essential to successful strategy. Here's where the discipline of systems thinking finds its greatest advantage. By using the systems archetypes we can learn how to "structure" the details into a coherent picture of the forces at play.

A THEORY OF WHAT HAPPENED AT PEOPLE EXPRESS

Disentangling a complex story such as People Express Airlines starts with identifying the forces that shaped its evolution and the structures that may have lain behind those forces. This can lead to a very different picture of a firm's problems than suggested by just looking at the events.

People Express started with an innovative product concept, and the lowest costs in the industry. (People Express was the first airline founded after the 1978 U.S. airline deregulation.) The airline boasted a combination of deeply discounted fares and friendly, no-frills services (for example, meals and baggage handling were extra charges). Flying People Express on many of its East Coast routes was cheaper

than taking a bus. This quickly attracted so many new customers that, by the third quarter of 1982, Burr announced at People Express's quarterly financial meeting: "We're now the biggest carrier, in terms of departures, at any New York airport."[4]

In its early days, with universal stock ownership, People's employees had tremendous morale buoyed by the company's rapid success and exciting vision. "I have never flown on an aircraft," wrote one journalist in 1982, "whose help is so cheerful and invested in their work."[5] As Burr said, "At People Express, attitude is as important as altitude."

But that early reputation, and those low prices, brought demand that began, by mid-1982, to outstrip the company's ability to serve. Lori Dubose, managing officer for Human Resources, was quoted as having trouble finding "enough people to staff adequately" and still "have some time for management development." By November 1982, one third of People's staff was temporary help—four hundred temporaries in all. In terms of simple head count, there were probably enough "Customer Service Managers," as People Express's service personnel were called, to keep pace. But the innovative job rotation and team management concepts meant that training and assimilation of service personnel took much longer than in more traditional airlines.

Despite these difficulties, demand for People's deep discount flights continued to grow phenomenally. Passenger seat miles more than doubled in 1982, and again in 1983. By the end of 1983, People was one of the most profitable carriers in the industry. Its stock was trading at $22 a share, up from $8.50 at startup. Despite being overworked, many of People's employees were growing wealthy. Burr preached the merits of hard work in the pursuit of a lofty vision: "People get more fatigued and stressed when they don't have a lot to do. I really believe that, and I think I have tested it. . . . It's sensational what direction can do. The beauty of the human condition is the magic people are capable of when there's direction. When there's no direction, you're not capable of much." Revenues doubled again in 1984, although profits did not rise proportionately.

Meanwhile, People Express's customers were complaining more about service problems. There were more and more ticketing and reservation delays, and canceled or overbooked flights. On-board flight attendants became less friendly and less efficient. Customers forgave all this at first, and kept returning to the airline. Thus, there was no apparent penalty for poor service. But during 1984 and 1985,

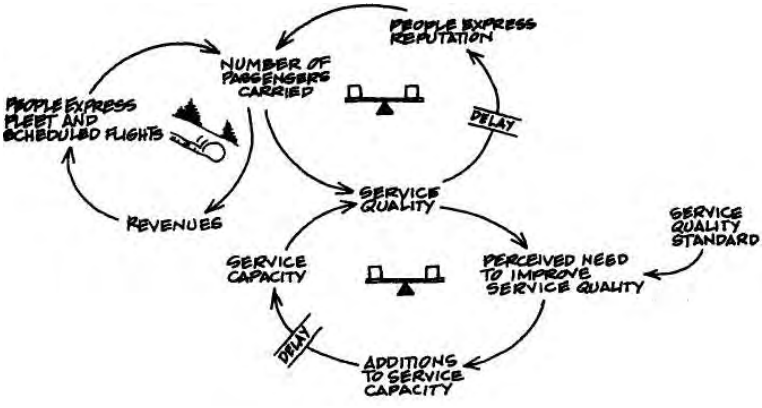
increasing numbers of customers began to trickle away. Growth became entirely driven by price, and People Express's customers became increasingly price conscious, not quality conscious. Eventually, People's stock price fell, which diminished morale and service further. By its last year of operation, flying People Express had become such a dismal experience that it was nicknamed "People Distress," and its once loyal customers began to patronize other carriers.

People Express's chronic problems with service quality and having enough competent and committed service personnel suggests subtle similarities to WonderTech, with its problems of inadequate manufacturing capacity and eroding delivery service—even though the specifics at People Express differed in almost every way from the specifics at WonderTech. WonderTech was a manufacturing company. People Express was a service business. Whereas the critical capacity variable at WonderTech was production capacity, the critical capacity variable at People Express was "service capacity," the composite of personnel, experience, and morale. WonderTech drove growth through aggressive additions to its direct sales force. People Express drove growth through aggressive additions to its fleet and flight schedule. WonderTech foundered because of worsening delivery times and eroding delivery time standards. People Express foundered because of declining customer service quality and standards for service. But despite all those differences, underlying both were the dynamics of growth and underinvestment, the systems archetype that explains one of the most common ways that organizations inadvertently limit their own growth.

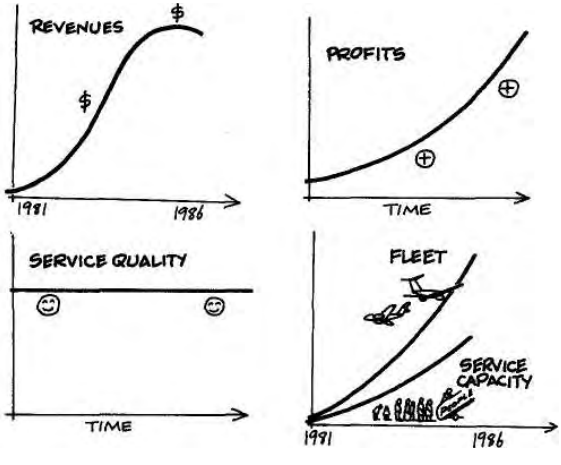
Below is how the growth and underinvestment structure looks, mapped onto the People Express story.

At People Express, this structure produced a pattern of rapid growth and equally rapid decline, which you can see in the following charts of behavior over the five years' time period.[6] Sales grew rapidly then slowed and then went into decline. Profits rose, then collapsed, and turned into large losses. Service quality started high then steadily eroded. Fleet size grew rapidly, as did the number of service personnel, but service capacity failed to keep pace with passenger growth.

For the managers at People Express, underinvestment was, perhaps, even harder to see than it was at WonderTech. After all, hadn't People been extremely aggressive in investing in aircraft capacity? But the *critical* underinvestment was in *service* capacity, not aircraft



capacity. Moreover, inadequate service capacity was masked, to a degree, by tremendous growth in total head count. People didn't fail to expand the *number* of service personnel to meet its customer growth; it failed to build the composite of people, skills, and organizational infrastructure that was needed to serve customer demand at high levels of quality.[7]



Yet, People Express *could* have been an enduring success, in the opinion of those of us who have tried to understand it systemically. It had a unique product-cost position that would have been very difficult for competitors to match. Had the firm been able to maintain

high service quality to go with its low fares, it would have been hard to beat. Falling to maintain service quality made price its only competitive advantage, which in turn made it vulnerable.

At MIT, John Sterman has created a computer-based "micro-world" of the People Express case history called the "People Express Flight Simulator." At the beginning of the school year, all incoming master's degree students in the Management School get to try their hand at seeing how well they might have done at the reins of People Express. As a learning tool, the flight simulator lets students try a wide range of policies and strategies in an attempt to exploit People Express's initial advantage in cost and market position. They try marketing promotions and price cuts. They try hiring more service personnel and less service personnel. They try not expanding the fleet so rapidly (e.g., not buying Frontier Airlines) and they try expanding more rapidly. They try redefining the "scope" of People's services to include more or fewer services for the basic fare. As they come to understand the growth and underinvestment dynamics, they come around to strategies that succeed in sustaining growth in revenues and profits, maintaining high service quality, and expanding service capacity at a pace in balance with passengers carried. The key is strengthening the "fundamental solution" of building service capacity. This is best done by *limiting* demand growth and by a commitment to service quality. Both objectives can be achieved through simple changes, especially through:

- 25 percent higher fares (still two thirds of average industry fares)
- Sustained, high service standards

Though simple, these high-leverage changes represent a shift in basic strategy. Sustained high service standards create a commitment to service quality as a competitive advantage. Many have suggested that People grew too fast, but the leverage lies in pricing somewhat higher, both to slow down growth *and* to increase profits to invest in building service capacity. Slightly higher prices would have left People Express with more room to maneuver (say by temporarily lowering price) when competitors started to chip away at the firm's price advantage. (In the simulator—even with a sharp drop in competitor fares, as occurred when computerized reservation systems were introduced—People Express still remains successful with the above strategy.)

In the end, People Express's executives' belief that the enemy was "out there" kept them from seeing the contradictions in their

own policies and strategies. The company sought **to innovate with** dramatically new ideas in human resource policies, yet it also **tried to** become a major national player in the airline industry within a **few** years. The two goals were internally contradictory. For example, **to** sustain 100 percent per year growth, you need "cookie cutter" jobs for which people can be trained in weeks, rather than the sophisticated human resource system requiring many months for people to master many different types of skills.

Consequently, the airline slipped into a vicious cycle of underinvestment and eroding quality (for both customers and employees) that belied all of the executives' original worthy ideals about employee management and customer service. It is impossible to say with certainty what would have happened if they had kept high service quality as an unshakable goal and priced their product so they could build adequate service capacity. With the right mix of policies, People Express's innovative human-resource policies and timely entry into the deregulated airline industry might have produced an enduring success story. One thing is certain, People Express had a unique industry position that would have been very difficult for major carriers to match if it had been able to sustain the enthusiasm and commitment of its people.

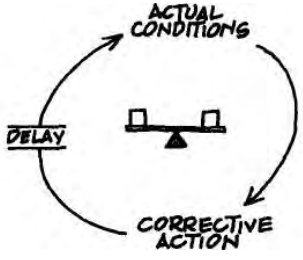
Mastering such basic archetypes as growth and underinvestment is the first step in developing the capability of seeing the forest *and* the trees—of seeing information in terms of broad and detailed patterns. Only by seeing both can you respond powerfully to the challenge of complexity and change.

But, ultimately, mastering the language of systems thinking also requires the other complementary learning disciplines. Each contributes important principles and tools that make individuals, teams, and organizations more able to make the shift from seeing the world primarily from a linear perspective to seeing and acting systemically.

APPENDIX 2: SYSTEMS ARCHETYPES[1]

BALANCING PROCESS WITH DELAY

Structure:



Description: A person, a group, or an organization, acting toward a goal, adjusts their behavior in response to delayed feedback. If they are not conscious of the delay, they end up taking more corrective action than needed, or (sometimes) just giving up because they cannot see that any progress is being made.

Early Warning Symptom: "We thought **we** were **in balance, but then we** overshot the mark." (Later, you may overshoot in the other direction again.)

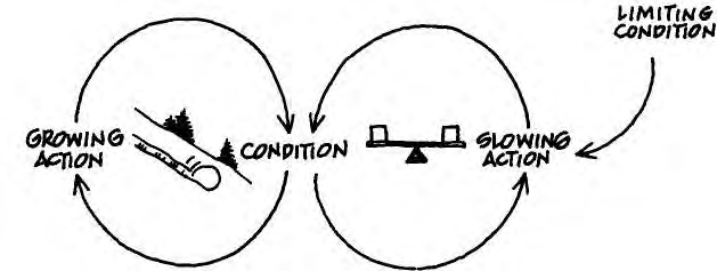
Management Principle: In a sluggish system, aggressiveness produces instability. Either be patient or make the system more responsive.

Business Story: Real estate developers keep building new properties until the market has gone soft—but, by then, there are already enough additional properties still under construction to guarantee a glut.

Other Examples: A shower where the hot water responds sluggishly to changes in the faucet positions; production/distribution glut and shortage cycles (such as that of the beer game); cycles in production rates and in-process inventory due to long manufacturing cycle times; the Tiananmen Square massacre, in which the government delayed its reaction to protest, and then cracked down unexpectedly hard; sudden, excessive stock market soars and crashes.

LIMITS TO GROWTH

Structure:



Description: A process feeds on itself to produce a period of accelerating growth or expansion. Then the growth begins to slow (often inexplicably to the participants in the system) and eventually comes to a halt, and may even reverse itself and begin an accelerating collapse.

The growth phase is caused by a reinforcing feedback process (or by several reinforcing feedback processes). The slowing arises due to a balancing process brought into play as a "limit" is approached. The limit can be a resource constraint, or an external or internal response to growth. The accelerating collapse (when it occurs) arises from the reinforcing process operating in reverse, to generate more and more contraction.

Early Warning Symptom: "Why should we worry about problems we don't have? We're growing tremendously." (A little later, "Sure there are some

problems, but all we have to do is go back to what was working before." Still later, "The harder **we run, the** more we seem to stay in the same place.")

Management Principle: Don't push on the reinforcing (growth) process, remove (or weaken) the source of limitation.

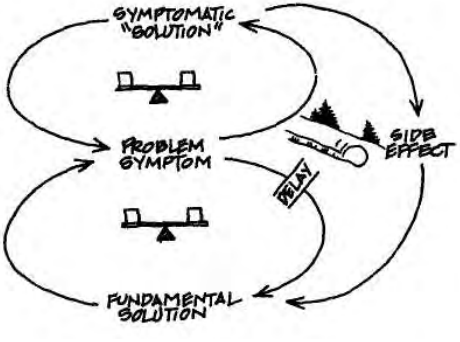
Business Story: A company instituted an affirmative action program, which grew in support and activity as well-qualified minority employees were successfully introduced into work teams throughout the company. But eventually resistance emerged; the new staffers were perceived as not having "earned" their positions over other qualified aspirants. The harder individual teams were pressured to accept the new members, the more they resisted.

Other Examples: Learning a new skill, such as tennis, you make rapid progress early on as your competence and confidence builds, but then you begin to encounter limits to your natural abilities that can be overcome only by learning new techniques that may come "less naturally" at first.

A new startup that grows rapidly until it reaches a size that requires more professional management skills and formal organization; a new product team that works beautifully until its success causes it to bring in too many new members who neither share the work style nor values of the founding members; a city that grows steadily until available land is filled, leading to rising housing prices; a social movement that grows until it encounters increasing resistance from "nonconverts"; an animal population that grows rapidly when its natural predators are removed, only to overgraze its range and decline due to starvation.

SHIFTING THE BURDEN

Structure:



Description: A short-term "solution" is used to correct **a problem, with** seemingly positive immediate results. As this correction is used more **and** more, more fundamental long-term corrective measures are used less **and** less. Over time, the capabilities for the fundamental solution may atrophy or become disabled, leading to even greater reliance on the symptomatic solution.

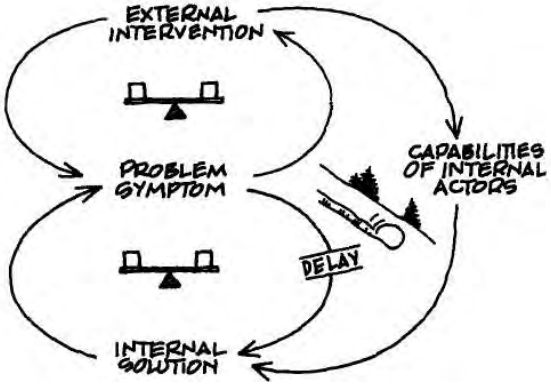
Early Warning Symptom: "Look here, this solution has worked so far! What do you mean, there's trouble down that road?"

Management Principle: Focus on the fundamental solution. If symptomatic solution is imperative (because of delays in fundamental solution), use it to gain time while working on the fundamental solution.

Business Story: A dramatic new circuit board technology can be used to develop unique functionality and cost savings in a great many new product applications, but it can also be substituted for existing boards in current products. Salespeople can try to sell to "specialty customers" who appreciate the special properties of the technology and will eventually design new products which exploit it fully (the "fundamental solution") or sell to "commodity customers" who do not care about its special properties and will simply substitute it for other boards (the "symptomatic solution"). Given management pressures to meet quarterly sales targets, salespeople sell to whoever is ready to buy, which usually will be commodity customers since there are more of them and delays in the selling cycle are shorter. Over time, the dramatic new technology fails to develop a loyal customer base and becomes subject to the price and margin pressures that characterize commodity products.

Other Examples: Selling more to existing customers rather than broadening the customer base (The "ATP case" from Chapter 12); paying bills by borrowing, instead of going through the discipline of budgeting; using alcohol, drugs, or even something as benign as exercise to relieve work stress and thereby not facing the need to control the workload itself; and any addiction, anywhere, to anything.

Structure:



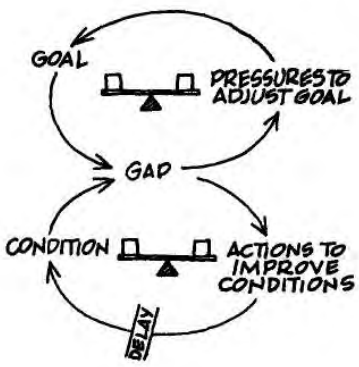
One area where shifting the burden structures are so common and so pernicious that it warrants special notice is when outside "intervenors" try to help solve problems. The intervention attempts to ameliorate obvious problem symptoms, and does so so successfully that the people within the system never learn how to deal with the problems themselves.

Management Principle: "Teach people to fish, rather than giving them fish." Focus on enhancing the capabilities of the "host system" to solve its own problems. If outside help is needed, "helpers" should be strictly limited to a one-time intervention (and everyone knows this in advance) or be able to help people develop their own skills, resources, and infrastructure to be more capable in the future.

Business Story: An innovative insurance company was committed to the concept of independent local offices that would call on headquarters staff only for occasional help. Initially the concept worked well, until the industry went through a crisis. Facing sudden severe losses, the local offices called in the more experienced central management for help in rewriting rate structures—a process which took months. Meanwhile, the local managers focused their attention on managing the crisis. The crisis was resolved, but the next time rate structures were called into question, the local offices had lost some of their confidence. They called in the central managers as "insurance." After several years of this behavior, the local offices found themselves without underwriters who could manage rate structure changes independently.

Other Examples: Dependence on outside contractors instead **of training your**
own people. Numerous forms of government aid that **attempt to solve pressing** problems only to foster dependency and need for increasing aid: **welfare** systems that foster single-family households; housing or job training programs that attract the needy to cities with the best programs; food aid **to** developing countries which lowers deaths and increases population growth; social security systems that reduce personal savings and encourage **the** breakup of the extended family.

ERODING GOALS



Structure:

Description: A shifting the burden type of structure in which the short-term solution involves letting a long-term, fundamental goal decline.

Eariy Warning Symptom: "It's okay if our performance standards slide a little, just until the crisis is over."

Management Principle: Hold the vision.

Business Story: A high-tech manufacturer finds itself losing market share, despite a terrific product and ongoing improvements. But the firm, oriented toward its design "geniuses," had never gotten production scheduling under control. An outside investigator discovered that customers were increasingly dissatisfied with late schedules, and were turning to

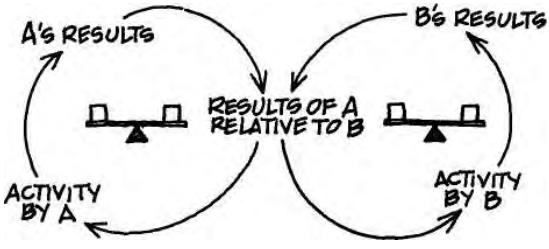
competitors instead. The company stood on its record: "We've maintained a consistent 90 percent success in meeting the delivery time quoted to the customer." It therefore looked elsewhere for the problem. However, every time the company begin to slip its schedules, it responded by making the quoted delivery

time a little longer. Thus, the quoted delivery time to customers was getting **lengthier, and lengthier, and lengthier . . .**

Other Examples: Successful people who lower their own expectations **for themselves** and gradually become less successful. Firms that tacitly **lower their** quality standards by cutting budgets rather than investing in developing new higher quality (and perhaps lower cost) ways of doing things, all **the** while proclaiming their continued commitment to quality. Lowered government targets for "full employment" or balancing the federal deficit. Sliding targets for controlling dangerous pollutants or protecting endangered species.

ESCALATION

Structure:[2]



Description: Two people or organizations each see their welfare as depending on a relative advantage over the other. Whenever one side gets ahead, the other is more threatened, leading it to act more aggressively to reestablish its advantage, which threatens the first, increasing its aggressiveness, and so on. Often each side sees its own aggressive behavior as a defensive response to the other's aggression; but each side acting "in defense" results in a buildup that goes far beyond either side's desires.

Early Warning Symptom: "If our opponent would only slow down, then we could stop fighting this battle and get some other things done."

Management Principle: Look for a way for both sides to "win," or to achieve their objectives. In many instances, one side can unilaterally reverse the vicious spiral by taking overtly aggressive "peaceful" actions that cause the other to feel less threatened.

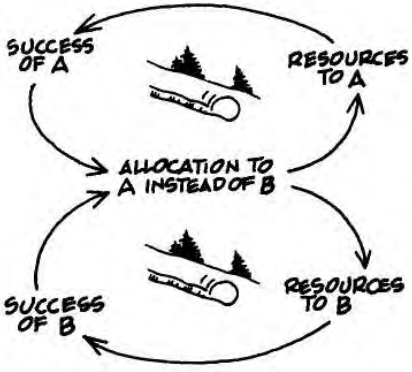
Business Story: A company developed an ingenious design for a stroller, which carried three toddlers at once, yet was light and convenient for travel. It was an immediate hit with families with several young children. Almost

simultaneously, a competitor emerged with a similar product. After several years, jealous of the other company's share of the market, the first company lowered its price by 20 percent. The second company felt a decline in sales, and lowered its price too. Then the first company, still committed to boosting share, lowered its prices still further. The second company reluctantly did the same, even though its profits were beginning to suffer. Several years later, both companies were barely breaking even, and survival of the triple carriage was in doubt.

Other Examples: Advertising wars. Increasing reliance on lawyers to settle disputes. Gang warfare. The breakup of a marriage. Inflating budget estimates: as some groups inflate their estimates, others find themselves doing likewise in order to get "their piece of the pie," which leads to everyone inflating his estimates still further. Battle for the "ear" of the president of a company. And, of course, the arms race.

SUCCESS TO THE SUCCESSFUL

Structure:



Description: Two activities compete for limited support or resources. The more successful one becomes, the more support it gains, thereby starving the other.

Early Warning Symptom: One of the two interrelated activities, groups, or individuals is beginning to do very well and the other is struggling.

Management Principle: Look for the overarching goal for balanced achievement of both choices. In some cases, break or weaken the coupling between

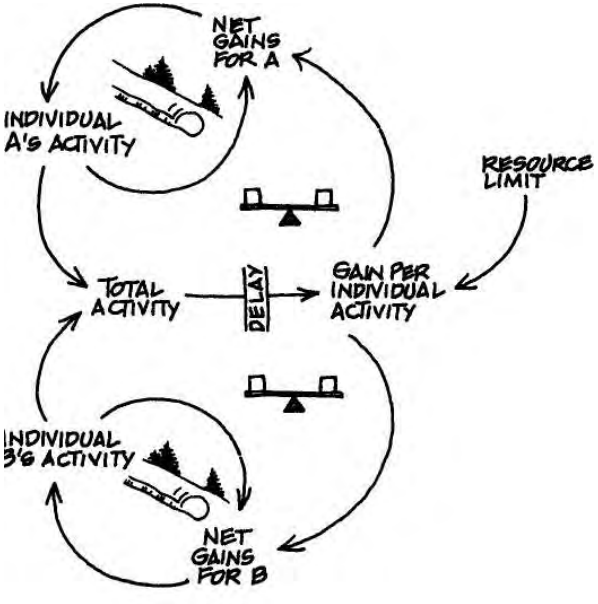
the two, so that they do not compete for the same limited resource (this is desirable in cases **where the coupling** is **inadvertent** and **creates an unhealthy** competition **for** resources).

Business Story: A manager has two proteges, and wishes to bring both along equally in the firm. However, one of the two ends up getting preferential treatment because the other is out sick for a week. When the second protege returns to work, the manager feels guilty, and avoids the person, thereby giving still more opportunity to the first protege. The first protege\ feeling **the** approval, flourishes, and therefore gets more opportunity. The second protege, feeling insecure, does less effective work and receives even fewer opportunities, although the two people had equal ability in the beginning. Eventually, the second prate" g6 leaves the firm.

Other examples: Balancing home and work life, in which a worker gets caught working overtime so much that relationships at home deteriorate and it gets more and more "painful" to go home, which, of course, makes the worker even more likely to neglect home life in the future. Two products compete for limited financial and managerial resources within a firm; one is an immediate hit in the marketplace and receives more investment, which depletes the resources available to the other, setting in motion a reinforcing spiral fueling growth of the first and starving the second. A shy student gets off to a poor start in school (perhaps because of emotional problems or an undetected learning disability), becomes labeled a "slow learner," and gets less and less encouragement and attention than his or her more outgoing peers.

TRAGEDY OF THE COMMONS

Structure:



Description: Individuals use a commonly available but limited resource solely on the basis of individual need. At first they are rewarded for using it; eventually, they get diminishing returns, which causes them to intensify their efforts. Eventually, the resource is either significantly depleted, eroded, or entirely used up.

Early Warning Symptom: "There used to be plenty for everyone. Now things are getting tough. If I'm going to get any profit out of it this year, I'll have to work harder."

Management Principle: Manage the "commons," either through educating everyone and creating forms of self-regulation and peer pressure, or through an official regulating mechanism, ideally designed by participants.

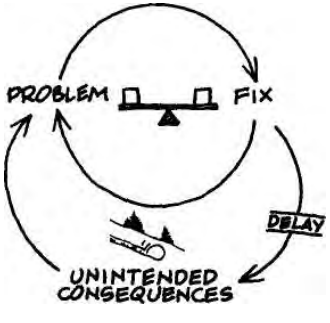
Business Story: Several divisions of a company agreed to share a retail salesforce. Each district manager was initially concerned that the shared salesforce wouldn't give enough attention to his or her particular business, and that volume would decline. One particularly **aggressive** manager ad-

vised all his account managers to set higher sales targets than were truly needed, so that the salesforce would at least give **them the minimum support** they needed. The other divisions saw this division pushing for extra work, and decided to employ the same strategy. The new salesforce's managers wanted to accommodate all of their "clients," so they continued to accept the higher requests from the divisions. This created a tremendous overburden of work, lowered performance, and increased turnover. Pretty soon, joining the retail salesforce was only slightly more popular than joining the French Foreign Legion, and each division had to go back to maintaining its own salesforce.

Other Examples: Exhaustion of a shared secretarial pool. Deteriorating reputation for customer service after customers have had to listen to six different salespeople from six different divisions of the same corporation pitching competing products. (The "shared resource" in this case was the firm's positive customer reputation.) A highly successful retail chain gives up on joint sales promotions with manufacturers after being deluged with proposals by enthusiastic manufacturers, or establishes terms for joint ventures that leave little profit for the manufacturers. Depletion of a natural resource by competing companies which mine it. And, of course, all manner of pollution problems from acid rain to ozone depletion and the "greenhouse effect."

FIXES THAT FAIL

Structure:



Description: A fix, effective in the short term, has unforeseen long-term consequences which may require even more use of the same fix.

Early Warning Symptom: "It always seemed to work before; why isn't it working now?"

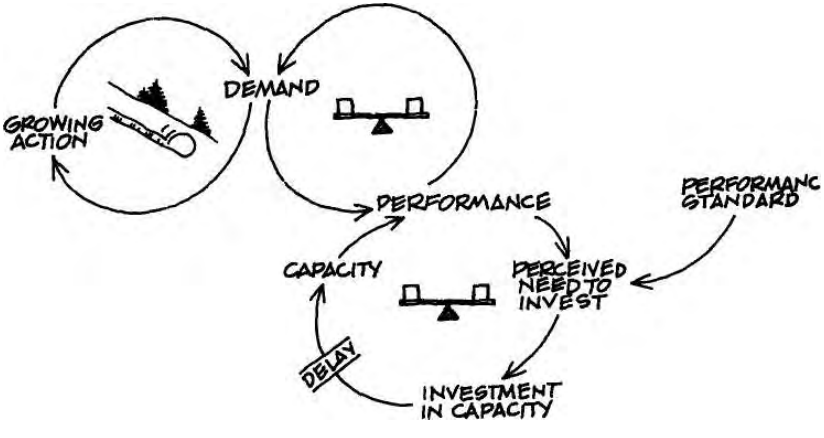
Management Principle: Maintain focus on the long term. Disregard short-term "fix," if feasible, or use it only to "buy time" while working on long-term remedy.

Business Story: A manufacturing company launched a new set of high-performance parts, which were wildly successful at first. However, the CEO was driven by maximizing his ROI, so he deferred ordering expensive, new production machines. Manufacturing quality suffered, which led to a reputation for low quality. Customer demand fell off dramatically over the ensuing year, which depressed returns and made the CEO even more unwilling to invest in new production equipment.

Other Examples: People and organizations who borrow to pay interest on other loans, thereby ensuring that they will have to pay even more interest later. Cutting back maintenance schedules to save costs, which eventually leads to more breakdowns and higher costs, creating still more cost-cutting pressures.

GROWTH AND UNDERINVESTMENT

Structure:



Description: Growth approaches a limit which can be eliminated or pushed into the future if the firm, or individual, invests in additional "capacity." But the investment must be aggressive and sufficiently **rapid** to forestall reduced growth, or else it will never get **made. Oftentimes, key** goals or

performance standards are lowered to justify underinvestment. When this happens, there is a self-fulfilling prophecy where lower goals lead to lower expectations, which are then borne out by poor performance caused by underinvestment. (This is the Wondertech structure described in Chapter 7.)

Early Warning Symptom: "Well, we used to be the best, and we'll be the best again, but right now we have to conserve our resources and not over-invest."

Management Principle: If there is a genuine potential for growth, build capacity in advance of demand, as a strategy for creating demand. Hold the vision, especially as regards assessing key performance standards and evaluating whether capacity to meet potential demand is adequate.

Business Story: As described in Chapter 8, the People Express Airlines, found itself unable to build service capacity to keep pace with exploding demand. Rather than putting more resources into training or growing more slowly (for example, through raising prices somewhat), the firm tried to "outgrow" its problems. The result was deteriorating service quality and increased competition, while morale deteriorated. In order to keep up with the continued stress, the company relied more and more on the "solution" of underinvesting in service capacity, until customers no longer found flying People Express attractive.

Other Examples: Companies which let service quality or product quality of any sort decline, simultaneously blaming competition or their sales management for not pushing hard enough to maintain sales. People with grand visions who never realistically assess the time and effort they must put in to achieve their visions.