

Systems Thinking

Four Key Questions

Barry Richmond

Managing Director
High Performance Systems, Inc.

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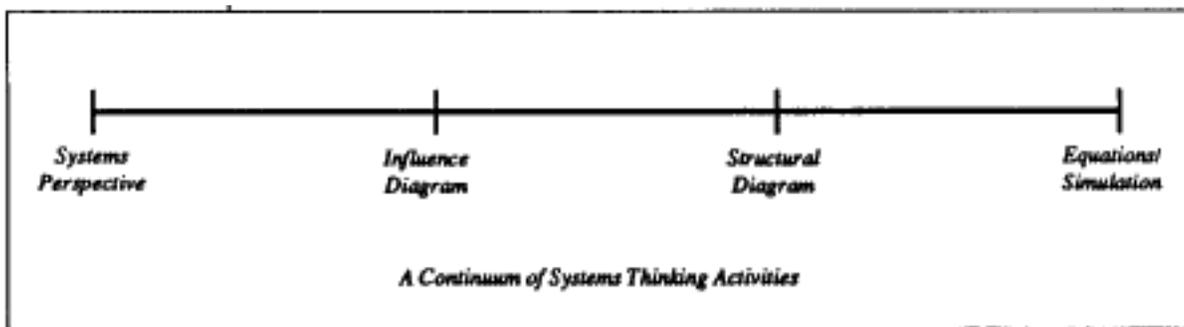
Four Key Questions

Systems Thinking, A Systems Approach, System Dynamics, Systems Theory, and just plain 'ol "Systems" are but a few of the many names commonly attached to a field of endeavor that most people have heard something about, many seem to feel a need for, and few really understand. This paper is an attempt to provide *concise* answers to four key questions about "systems". Each answer really could be developed in a great deal more detail. What I've tried to do is provide a starting point—what I hope is a good springboard.

As I prefer the term "Systems Thinking", I'll use it throughout as the single descriptor for this field of endeavor. The questions that I will seek to answer about Systems Thinking are: *What is it? Why is it needed? What works against its being adopted on a broader scale?* And, finally: *What can we do to increase both the speed and breadth of its adoption?* I am hopeful that the answers which I provide will help to fill something of an information void as to what this "systems stuff" really is all about. They also should help to focus and leverage the efforts of both those seeking to develop proficiency in the field, as well as those who are working to encourage a broader adoption of the approach.

What is Systems Thinking?

Systems Thinking, in practice, is a continuum of activities which range from the conceptual to the technical:



At the conceptual end of the spectrum is adoption of a systems perspective or viewpoint. You are adopting a systems viewpoint when you are standing back far enough — in both space and time — to be able to see the underlying web of *ongoing, reciprocal relationships* which are cycling to produce the patterns of behavior that a system is exhibiting. You're employing a systems perspective

when you *can* see the forest (of relationships), for the trees. You are *not* employing a systems perspective when you get "trapped in an event". Anyone who has gazed out at the lights from high above a city, or gazed down upon a river valley from a mountain top, has a good sense of what "standing back far enough" means. Details fade. Patterns of relationships emerge. And, time seems to slow. Conversely, anyone who's been caught in the frenzy of rush hour traffic on a multi-lane freeway knows what being "trapped in an event" really means. The former is inherently awesome, empowering and expansive. The latter is inherently mundane, consuming and constraining.

Moving rightward along the continuum, activities become more concerned with implementation of the viewpoint. As they do, they also become progressively more disciplined and analytical. You might typically begin implementation by developing an influence diagram — a simple map of the reciprocal relationships which you believe to be principally responsible for producing the behavior patterns that a system is exhibiting. These maps basically show what's hooked up to what. Next, you might construct a structural diagram. This is a more disciplined map. It attempts to show what really makes a system tick. At this stage of the process, you're laying out the mechanisms you think the system is using to control itself. Finally, you might take the step of translating the structural diagram into a set of equations. The equations characterize the nature of the relationships that you laid out in your structural diagram. This activity also includes assigning numerical values to define the direction and strength of these relationships. Completing this step enables you to simulate the system's behavior on a computer. Being able to do this often is very important because it permits you to "close the loop" on your thinking. You can answer the question: *Can the set of reciprocal relationships that I've pieced together in fact generate the behavior patterns that are being produced by the actual system?*

Few practitioners of Systems Thinking are equally proficient at all activities along the continuum. And few applications of Systems Thinking involve all activities. It is clear, however, that to be good at any of the implementation activities, it is essential to have a firm grasp on the perspective. There are many talented equation writers. There are few people who can construct good Systems Thinking simulations models.

Why is Systems Thinking Needed?

The easiest problems to solve are "local" in both space and time. If you tip over a glass of milk, there really is no need to cry. The spill will confine itself to a relatively small area. And, spilled milk doesn't stain. So, you simply fetch something absorbent, plop it down, soak up and then discard the errant booty. No traces. No remorse. No problem.

Now consider spilling either radioactive waste, "the beans", or "your heart out". Each of these "spills" will have far broader and longer-lasting consequences than spilled milk. And, in each case, the consequences ramify far from their point of origin in both space and time. They affect not just the "spiller" and the immediate area. The impact no longer is "local". Indeed, applying local solutions to far-reaching spills usually only serves to make things worse both locally and distally.

As our personal relationships, technologies, jobs, institutions and communities continue to grow increasingly complex and interdependent, the occurrence of "spills" will increase. At the same time, the chances of any spill remaining "local" diminish. Almost any "fix" that we implement reverberates

through a web of interconnections, producing a wave of counter-reactions that are widely distributed in both space and time. Only by increasing our appreciation for the growing "systemicness" of our reality, can we begin to function as responsible web-mates, and can our social institutions (from families, to corporations to governments) achieve some modicum of effectiveness and stability. As interdependency increases, we must learn to learn in a new way. It's not good enough simply to get smarter and smarter about our particular "piece of the rock". We must have a common language and framework for sharing our specialized knowledge, expertise and experience with "local experts" from other parts of the web. We need a systems Esperanto. Only then will we be equipped to act responsibly. In short, interdependency demands systems thinking. Without it, the evolutionary trajectory that we've been following since we emerged from the primordial soup will become increasingly less viable.

What works against the adoption of Systems Thinking?

So, if -- as it would appear -- the case for developing increasing proficiency in Systems Thinking is so compelling, why then has its adoption been so slow? I believe that there are seven major impediments to the rapid and wide-scale assimilation of Systems Thinking. I have divided the seven into two classes, although the compartments are far from hermetically separated. I have classed three of the impediments as "situational". By this I mean that we, ourselves, largely create these impediments. This implies that we, ourselves, can directly do something about them. By altering our behavior, the form of our institutions, the way we "do business", we can do much to eliminate the impediments in this class.

I have labeled the second class of impediments "fundamental". Impediments in this class arise more out of "the way things are"; i.e., the nature of "objective reality", and the legacy of our biological heritage. To the extent that things really are the way you perceive them to be, and that intentionality can exert some influence over biology, we have some power to lessen these more "fundamental" impediments as well. Personally, I am optimistic. I feel there is much that we can do to remove the barriers to wide-scale adoption of Systems Thinking.

Fundamental Impediment Number 1

The first of the "fundamental impediments" to the adoption of Systems Thinking is that we're prisoners of our frame of reference. Ever have the experience of visiting another continent? Somewhere where people speak a different language, and have adopted a different set of customs? Invariably, after you're there for awhile, you begin to see things about your homeland that previously had been invisible. You couldn't see them at home because you'd been living and breathing them since birth. They had become part of your "givens", your stock of taken-for-granted assumptions. This unconscious bedrock is the source of a fundamental impediment to the adoption of Systems Thinking. Because of it, it's difficult to "stand back far enough" to really see what's what.

Few of us live on the upper floors of skyscrapers or atop mountain crests. And, even those of us who do, can ill afford to spend much time gazing out. Most of our waking hours are spent "in the fray". We're down there in that traffic flow. We're participating in that meeting in the Conference

Room. We're writing that memo, or doing that analysis. We spend most of our time right up against the reality, interacting locally in particular parts of the web. In short, when you're part of the action, it's very difficult to *simultaneously* "stand back far enough". The fray thus becomes your unconscious bedrock. To take an extreme example, few people practice Systems Thinking on slow-moving, crowded elevators! The attachment to the here and now simply is too complete.

It is possible to develop the ability to "sense the whole while you're playing a part". Yogis, consultants, teachers, jazz musicians, and consummate team players all have it to varying degrees. However, it does take time to develop. And, without a sustained effort to hone this skill you'll remain solidly manacled to the fray.

Fundamental Impediment Number 2

The second "fundamental impediment" to adoption of Systems Thinking really is an artifact of the first. Because we live in fray, we've accumulated a storehouse of fray-conditioned experiences. These experiences, in turn, color the way we view and interpret subsequent experiences. The prevailing interpretation, combined with the weight of evidence in the storehouse, make it difficult to adopt a Systems perspective.

Nearly all of our everyday experiences, as they unfold, appear to be "open-loop". That is, they do not appear to be the product of *ongoing reciprocal processes* — as a Systems perspective would have you believe. Instead, they look and feel like *one-way* occurrences. For example: we get hungry; we eat; hunger is gone. Or, we're late; we step on the accelerator; we make it on time. Such sequences, as experienced, are much like those that you'd have in a carnival shooting gallery. A target pops up...BLAM... you blow it away. Next target, please. The sense, that one derives from the flow of such experiences is that of facing an oncoming stream of "to do's" which pop up, and which then must be "dealt with." Individuals have little sense of their role in *creating* the stream. They're simply the "shooters". Working folk. Someone else is controlling what's coming down the pike. Living is responding.

One important reason why the flow of experience seems like a shooting gallery is that there's frequently a significant asymmetry in the elapsed time associated with the two links which make up a reciprocal relationship. Specifically, it takes much less time for an action to produce a result, than it does for the result to return to initiate another action. As a consequence, it's easy to conclude that your role is only to "fix it" when something pops up, and not that your "fixes" are part of a circular process which ensures that the something will pop up again! Take the hunger example. You sense hunger. It then usually takes 15-20 minutes of concerted effort to "fix it". Once hunger disappears, it stays gone for 3-4 hours. There are usually lots of non-hunger-related things to occupy your attention during this intervening period — a period in which you're *undoing* what you just

fixed (i.e., storing and burning up the calories that you just took in). And then...bingo! Up pops the target again.

The pattern is the same for most of our everyday experiences. We're awake for 18 hours. We then "fix" the resulting fatigue by assuming a horizontal position, shutting our eyes, and letting go. Before we know it (because we've lost conscious track of time), bingo! We're back, ready to tire ourselves out again. Although it's always a circular process, we tend to see only *one* of the two links in the causal chain because the "un-fix" link takes so much longer to complete than the "fix" link. We are therefore led to conclude that our relationships in fact are *one-way* rather than *circular*. This, in turn, encourages us to view ourselves as "responders to" rather than "creators of." Such viewpoints are antithetical to a systems perspective, and hence mitigate against its adoption.

*Fundamental
Impediment
Number 3*

The third of the "fundamental" blocks to the adoption of Systems Thinking has to do with what you see when you open your eyes. No matter whether your gaze is from afar, or "up close and personal", when you look with your eyes, you see "stuff". You see material things like people, cars and buildings. You have to squint (with your mind) to see relationships. But the very essence of Systems Thinking is being able to perceive *relationships*, not objects! This means that those who choose to adopt this view are doomed to a life of squinting. Squinting takes effort, more effort than simply opening your eyes and letting the appropriate chemical receptors be simulated. And, although with time, squinting gets easier, it still takes more energy than just opening your eyes. This extra energy requirement, particularly in the start-up phase, serves as the third impediment to the adoption of Systems Thinking.

*Fundamental
Impediment
Number 4*

The final "fundamental" impediment to the assimilation of Systems Thinking is an artifact of our biology. It has to do with our survival instincts. Long ago, we acquired the baggage which enables us to react. We're here today, as a species, because when something went bump in the night in the primeval forest, we reacted! In today's more ritualized jungle, saber toothed tigers have ceased to be a concern. Now, with the lights *on*, we must instead deal with snakes in the grass in the conference room and foreign predators. And, when confronted with these ritualized threats to our survival, our biology still reacts in essentially the *same* way. Our instinct is to lash out with a knee-jerk reaction. Survival instincts triumph over intuition and reflection. Ready, fire, aim.

Reactions work fine, when they're local. However, in a web, they can wreak havoc! Most people know this. But oftentimes, especially in the heat of the moment, knowledge is no match for hormones. When it's the fourth quarter of a critical year, and you've got two weeks left to "make your numbers," you're not

going to find high enrollments in Systems Thinking seminars! The problem is that — for too many people, in too many organizations — it's *always* Q4 of a critical year, and there *always* are just two weeks left. Because of our evolutionary baggage, and because of the "perpetual fire fight" which exists in many organizations, Systems Thinking remains only a curiosity—something to explore sometime soon. The irony here is that to the extent that reactionary fixes serve as kindling for the next blaze, "sometime soon" will never arrive.

Fire-fighting really is a situational impediment. It can be managed. It's the existence of a great capacity for generating knee jerks that's fundamental. The existence of the capacity predisposes creation of a fire-fighting environment. The developing environment then provides ample opportunities for nourishing and sustaining the capacity. This vicious cycle, operating in many organizations, constitutes a formidable barrier to the adoption of Systems Thinking.

*Situational
Impediment
Number 1*

The first situational impediment to the assimilation of Systems Thinking is lack of technical expertise. People sniff the air surrounding this "systems stuff", smell computers, and then promptly proceed to have nightmares about high school algebra problems that they were never able to solve (and the final is tomorrow.) Although advances in technology are making technical impediments less of an issue, for some people, technology itself is frightening, de-humanizing, or otherwise dastardly. To fully implement Systems Thinking, it's likely that you'll need to rely on a computer and an equation or two somewhere along the line. The human mind simply is not capable of juggling all the actions and counter-actions in a complex web of relationships. In point of fact, only addition, subtraction, multiplication and division are needed. Until we let go of our "math anxiety" and technology phobias, Systems Thinking will largely remain on the shelf.

*Situational
Impediment
Number 2*

The second situational impediment really is a "resistance." People resist Systems Thinking because it can be threatening. It can be threatening in several ways.

People who rely on information monopolies, specific technical expertise, or sharply-demarcated turf boundaries, in order to sustain their sense of personal power, will find Systems Thinking inherently threatening. Pursuing a problem with Systems Thinking tends to carry you across disciplinary, cultural, and functional boundaries. The search is for how the web of interdependencies is creating the problem. Answers to the "how" usually do not lie within a single fiefdom, or within a particular part. Rather, they involve altering the relationships *between* fiefdoms, changing the way the parts play together, working at the interfaces. Such pursuits threaten local power bases. They can create "turf issues". They can (and usually do!) reveal gaps in knowledge bases. Scary stuff, this!

For all of these reasons, Systems Thinking does not tend to root very well in organizations which operate via traditional top-down, hierarchies. Organizations

where the people at the top always "know the answer", and the people below merely pull the triggers when the targets pop up, are not places where Systems Thinking will flourish. In organizations where power is delegated, individual development and autonomy are celebrated, and competitive advantage is perceived to depend on everyone getting smarter together, Systems Thinking can blossom!

*Situational
Impediment
Number 3*

The third, and final, impediment that I'll mention is the analogue of situational impediment number 2 at the level of the individual. For a person to be *willing* to adopt a Systems perspective she or he must feel empowered. It takes courage and strength to believe that you *can* make a difference in the way a *system* works. You obviously can not *control* the whole system, as you could a local piece. Hence, the commitment to influencing something that you know you can't "control" really is an admission of some lack of power. But there's a paradox here. To make such an admission, you must feel empowered. It takes strength to own up to weakness. The owning up is what enables you to operate from a position of strength.

Individuals who lack a sense of personal power, or who sustain this sense by trying to remain "in complete control" (via any one of a multitude of strategies), will resist Systems Thinking. Just as a skyscraper can be terrifying to someone who fears heights, Systems Thinking will spook individuals who lack a true sense of empowerment. In embracing this approach, you must give up control in exchange for gaining influence. You must trade knowing for continual learning. You must accept trust in exchange for dominance. It's difficult for disempowered individuals to accept any of these exchanges.

What Can Be Done to Facilitate the Adoption of Systems Thinking?

The seven impediments which I have identified, in effect, constitute an agenda of things which can be done to increase the rate of assimilation of Systems Thinking. This agenda does not include seeking to alter the fundamental conditions of our existence. It is likely therefore, at least for the foreseeable future, that we'll continue to see material objects (and not relationships) when we open our eyes. And, it's also likely, that in our day-to-day activities we'll be "right up against" those objects — rather than three steps back from the fray. The "fundamentals" won't change. However, we can take steps to expand and sensitize our perceptual filters. We can systematically confront our unconscious bedrock. And, we can develop our intuition for web dynamics. One tool which offers tremendous potential in all of these pursuits is the personal computer.

As pc's grow more powerful and more widely available, they'll also grow in their capacity for underwriting simulated "stand far enough back" experiences. As links to video disks become more common, and graphics-generation becomes ever more powerful, we'll become less and less tied to

actual experience as the primary medium for producing awe, empowerment and heightened perceptual sensitivities. Increasingly, we'll be able to use personal computers to create active, visceral learning environments where both individuals and groups can engage in Systems Thinking. Simulations can be used to compress space and time. In this more *intense* mindscape, the full systemic ramifications of many alternative courses of action can be "experienced" rather than merely conceived of. The potential for creating new ways of learning — for both individuals and groups — that is inherent in the nexus of the evolving technologies of personal computers, sophisticated sound systems, and interactive video disks, is enormous.

A second arena in which we can advance the cause of Systems Thinking is in formal education. We need offerings (at all levels) which address what's *similar* between disciplines, rather than courses that celebrate what's different. Part of the reason why we so easily become "trapped in the specifics" is that we are conditioned via formal education to analyze, to decompose, and to attend to the details of each part. Too little effort is spent in developing peoples' ability to see what's generic, what persists across disciplinary boundaries. Not enough time is devoted to exercising peoples' "intuition for the whole". As a result, when survival instincts are stimulated, it's knee-jerk reaction that gets the call.

The third arena in which significant improvements which favor the adoption of Systems Thinking can be made, lies within our social institutions — our families, social groups, corporations and public institutions. Any organization which operates in a "power flows from the top down" manner will resist adoption of Systems Thinking. At the same time, individuals operating within such organizations will feel little need, and lack a sufficient sense of empowerment, to adopt this framework. Only in institutions where individuals really can, and *feel* that they really can, make a difference, is it possible for Systems Thinking to take root. These organizations need to be sought out. Efforts to implement Systems Thinking need to be focused here. Too much of the limited time and effort of Systems professionals now is being spent on organizations who hold little promise of flattening their hierarchies and giving individuals real power. Let success in the individual-empowered organizations speak for itself. Power-centralizing organizations then will either adapt or perish.

If the arrow of evolution — coursing toward ever-increasing interdependency — is to remain aloft, it is essential that Systems Thinking be more widely embraced. Webs are exciting but fragile environments. Ours, at all levels, are showing signs of wear. The time is now.