

## CHAPTER 3

# Systems Intelligence: Connecting Engineering Thinking with Human Sensitivity\*

Esa Saarinen and Raimo P. Hämäläinen

*This paper outlines the basic features of Systems Intelligence and discusses some of its fundamentals. Systems Intelligence combines insights of Systems Thinking with a pragmatic orientation and philosophy of life. We argue that Systems Intelligence is a new concept that is highly useful for understanding human behaviour in complex interactive settings, and in concrete efforts to generate change. We suggest that Systems Intelligence is something we apply as humans instinctively. Systems Intelligence combines engineering thinking with human sensitivity and thus serves as a foundation for a down-to-earth pragmatic philosophy of life of optimism and change.*

### Introduction

By Systems Intelligence (SI) we mean intelligent behaviour in the context of complex systems involving interaction and feedback. A subject acting with Systems Intelligence engages successfully and productively with the holistic feedback mechanisms of her environment. She perceives herself as part of a whole, the influence of the whole upon herself as well as her own influence upon the whole. By observing her own interdependence in the feedback intensive environment, she is able to act intelligently.

*Systems Intelligence reaches beyond Systems Thinking in its pragmatic and active, personal and existential emphasis.*

We believe that Systems Intelligence is a key form of human behavioural intelligence.

Systems Intelligence combines insights from a variety of disciplines and schools of thought. For us, a particular inspiration is the work of Peter Senge (1990, 1994, 1999).

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Like the forms of intelligence described by Howard Gardner (1983, 1999), as well as emotional intelligence as explicated by Daniel Goleman (1995, 1998), Systems Intelligence deals with the structures human agents use in order to conduct their lives successfully. Like Gardner in his groundbreaking work on Multiple Intelligences, Systems Intelligence is not only restricted to the verbal, analytic and conceptual aspects of intelligence. In his own criticism of Multiple Intelligences Gardner (1983) refers to higher-level cognitive capacities, which are not explained by it. These include common sense, metaphorical capacity and wisdom. Systems Intelligence, as defined here, is another important human competence not covered by Multiple Intelligences.

Systems Intelligence points beyond the forms of intelligence of Gardner and Goleman in linking intelligence with the concept of system.

Traditional Systems Thinking literature (see e.g. Churchman 1968; von Bertalanffy 1969; Checkland 1999; Flood 1999) emphasizes the importance of wholes and perspectives as it conceptualises and models systems of interaction and feedback from outside. In contrast to that Systems Intelligence wants to account for the active and practical thinking that human agents use in real life situations involving complex systems of interaction with feedback mechanisms. Systems Intelligence reaches beyond Systems Thinking in its pragmatic and active, personal and existential emphasis.

In this paper we give a programmatic introduction to the concept of Systems Intelligence, sketch out some of its different forms of manifestation and discuss its fundamental role in human life. The paper can be seen as a program description and starting point for a research initiative<sup>1</sup> in the analysis of this new intelligence paradigm.

## Key Ideas of Systems Intelligence

Systems Intelligence makes use of some key ideas of Systems Thinking (Churchman 1968, 1969; von Bertalanffy 2001; Senge 1990; Checkland 1999; Flood 1999), Theories of Decision Making and Problem Solving (Simon 1956, 1982, 1997; Newell and Simon 1972; Rubinstein 1986; Ackoff 1987; Keeney 1992; Kahneman and Tversky 2000), Philosophical Practice and Dialogue (Bohm 1980; Isaacs 1999; Schuster 1999), a number of other forms of holistic thinking and of the human sciences as well as certain forms of therapeutic thinking, positive psychology and situation analysis (Bateson 2000; Goffman 1974; Haley 1986; Seligman 2002; Baker 2003). A major source of inspiration is also the Socratic tradition in philosophy which emphasises conceptual thinking for the purposes of the good life (Hadot 1987 and 1995; Long 2002). The reader is referred to the related literature to learn the historical roots of each of the ideas. Here we shall give a programmatic sketch of a new approach to understand human intelligence in a systems setting which is built on ideas described below.

- Whole is more important than parts.
- Human agents can influence entire systems.
- “Part” and “Whole” are relative abstractions that are always subject to potential redefinition by changing the perspective.
- Systems approach starts when you perceive the world through the eyes of another person.
- Systems approach looks beyond isolated linear cause-and-effect chains for interconnections and interrelations.

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<sup>1</sup> <http://www.systemsintelligence.hut.fi/>

- In our culture the human conceptual system emphasizes linear thinking, isolating thinking and seeing separate units rather than seeing wholes.
- Our perception mechanisms exhibit a similar tendency.
- Human beings perceive themselves as independent individuals, yet they most often are encompassed in systems.
- Structure produces behaviour.
- Beliefs regarding structures produce behaviour.
- Beliefs regarding the beliefs others have regarding structures, produce behaviour.
- Co-operation is natural but extremely hard to conceptualise in a behaviourally relevant, subjectively convincing manner.
- Structures of co-operation are fundamentally based on the assumptions and meta-assumptions people make of others involved in that system of co-operation.
- The behaviour of people often reflects their best guess of rational behaviour but that guess can be completely erroneous.
- People can get caught in systems that serve nobody's interest.
- Much of the time, people display behaviours they would change if they only could see the bigger picture of the setting they are in.
- A system can make people act in some undesirable ways but as people act in such ways, they maintain the system and its influence upon the others, partly causing the system of undesirable behaviours to regenerate itself.
- There does not need to be an external reason for the particulars of a system, yet people in the system can feel helpless regarding their possibilities of changing the system.
- In most systems, each subject separately reacts to the system without seeing the cumulative overall effect of the reactive behaviours on the others.

## The System Concept

Here we shall use the concept of a system intuitively. In the last chapter of this paper we shall discuss links to the related systems theoretic concepts. The principal features of a system for us are:

- A system is characterized by the interconnections of its elements, as well as the internal nature of those elements.
- A system has generative power. It produces effects beyond the modes and functionalities of its elements.
- A system has primacy over its elements while at the same time the elements influence the system.
- A system has emergent features, not reducible to the features of its elements.

Examples of human systems include: Party, Lecture, Meeting, Family, Friendships, School, Village, Society, Organization, Company, Industry, Administration, Traffic, Internet, Language, Parenthood, Global economy, etc.

## Paradoxes in Human Systems

Consider the following cases:

- Most managers want to support their team members more than they currently do. Most team members would want to get more support from their managers. Yet more support does not result. There seems to be *a systemic non-support generator* in place.
- Most husbands would want to be more romantic with their wives. Most wives would want their husbands to be more romantic with them. Yet more romantic behaviours do not result. There seem to be *a systemic non-romantic behaviour generator* in place.
- Most lecturers would like to give their best in a given lecture, also when people seem restless and even negative and come in late. Most people in the audience would like the lecturer to give her very best, even at a lecture for which he came late and might not seem that focused early on. But the lecturer cannot give her best, the audience does not receive the best, and everyone is disappointed. There seems to be *a lousy-lecturing-behaviour generating system* in place.
- Most people in the industrial world would like to produce less waste. Most companies would like to produce less waste. But more waste is produced. There seems to be *a waste-generating system* in place.
- Most adult readers would like to see more responsible, holistic and broadly-minded journalism. Most journalists would like to produce more responsible, holistic and broadly-minded journalism. But the opposite seems to happen. There seems to be *a system in place that generates relatively irresponsible, fragmentary and narrow-minded journalism*.

Saarinen has explored this kind of paradoxes in the context of his accessible-to-all-lecturing (lecturing as a Philosophical Practice) which following the Socratic tradition aim to provide platforms of change, reflection and renewal for academic and non-academic people (Saarinen and Slotte 2003). The experience is that people irrespective of their background find it easy to identify such paradoxes from their everyday life. Furthermore, becoming more aware of such paradoxes helps many people avoid the traps involved, often with astonishing results.

A husband may see his wife in the course of a Saarinen lecture with different eyes and from a fresh perspective. This may lead to a small but significant change later in the evening as the spouses meet. The wife may be encouraged to react with a small but significant positive change vis-à-vis the husband. A positive loop may now be generated and yet the day before apparently nothing could have been changed.

*Most people in the industrial world would like to produce less waste. Most companies would like to produce less waste. But more waste is produced. There seems to be a waste-generating system in place.*

The four dimensions of change are:

- Mental change
- Perceptual change
- Individual behavioural change
- Change in the system.

The research group lead by Raimo P. Hämmäläinen<sup>2</sup> has studied extensively the modelling of complex systems as well as the mathematical models of decision making, competition and co-operation. What we call Systems Intelligence started as an effort to combine the concrete-life oriented approach of Esa Saarinen's Socratic Philosophical Practice<sup>3</sup> with Hämmäläinen's systems research and thinking. Some first results have been described in the volume of our student essays (Bäckström et al. 2003) and first working papers (Hämmäläinen and Saarinen 2004a, b).

## The Moral of Systems Intelligence

Systems Intelligence is about the betterment and improvement of human life. The idea is to take the ancient promise of philosophy seriously, the one that called for the Good Life, and to use a systems approach to the benefit of such a process.

Surprisingly, the cause of the good life has not occupied the central focus of psychology or of philosophy in the past decades. Notable exceptions are de Botton (2000), Comte-Sponville (2001) and in psychology the work of Seligman (2002). In systems thinking tradition, the work of C. West Churchman is marked for his strong moral motivation but his work has not received the credit it is due (see e.g. Churchman 1982).

We believe our organizational behaviours, family life, individual lives, communal lives and co-operation in general can be improved enormously by relatively simple means that address the systemic perspective. The moral driver of Systems Intelligence is the creed that such profound changes of utmost human relevance hinge on Systems Intelligence.

## Examples of Systems Intelligence in Action

Someone presents an astonishing proposal.

- a. A Low Systems Intelligence Someone reacts, "That is so stupid and so wrong".
- b. A High Systems Intelligence Someone continues, "Striking. Tell me more."

A lady is at home with his boyfriend. They watch TV. Suddenly the boyfriend picks up the remote control and switches the channel.

- a. Low Systems Intelligence: The lady says, "What do you think you are doing, Mr Wise Guy?"
- b. High Systems Intelligence: The lady says, "Was this our decision?"

Much of what Senge describes as "inquiry mode", as opposed to "advocate mode" can be understood in terms of high Systems Intelligence.

A guy has a drinking problem.

- a. Low Systems Intelligence: The guy gets furious any time his lady suggests he might have a slight drinking problem.
- b. High Systems Intelligence: The guy turns to his lady and says, "How could we work on this major personal problem I have?"

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<sup>2</sup> <http://www.sal.hut.fi/Personnel/Homepages/RaimoH.html>

<sup>3</sup> <http://www.esasaarinen.com/?sivu=86&kieli=en>

We propose that the following forms of change-creation should be conceived in terms of Systems Intelligence in action:

- Job rotation, as a result of which people gain deeper understanding of the whole organisation
- The mirroring technique of certain forms of family counselling, where both parties are asked to repeat what the other just said, in order to show he or she has understood and is willing to listen to what the other just said (see e.g. Hendrix 1990).
- Parents talking to their child well before she shows any signs of learning a language.
- The first two axioms of Alcoholics Anonymous (1939) that say: “We admitted we were powerless over alcohol – that our lives had become unmanageable” and “Came to believe that a Power greater than ourselves could restore us to sanity”. (For a discussion of AA from the systems perspective see Bateson 2000.)

Harri Kontturi (2004), a Finnish attorney-at-law tells, relates in Hämäläinen and Saarinen (2004 a) a story of an old sea captain who in his last will indicated for each of his valuable memorabilia the recipient and connected in his will the memorabilia with a personal message that identified the reasons for the decision on a human and emotional level. “The sea painting from the dining hall I give to my daughter Kaisa because when I returned from the seas she always wanted to sit on my lap in front of this painting and hear my adventures on the voyage from which I had just returned.” “Let this painting be an eternal window to those cherished shared moments and to voyages you can return to in your memories again and again.” Thus the will continued for seventy seven pages. As the attorney came to the end, everybody was touched and nobody challenged a detail of the will. The sea captain’s Systems Intelligence bypassed the systems of envy and greed that so often poison similar estate inventories.

## **Virtues as Intelligence for Practical Life**

Systems Intelligence links with the ancient promise of philosophy that challenged people to ask: How to live a good life? Systems Intelligence aims to enhance the prospects of good life and in doing so it relates to what Aristotle called practical reason rather than theoretical reason. The theme of Systems Intelligence is a “know how” rather than “know that”. The understanding required will be judged by its practical outcome and manifestation in conduct.

Traditionally, virtues were perceived as excellencies of life. Virtues such as wisdom, courage, prudence, justice, politeness or mercy related people to other people around them as well as to the bigger picture of life. When people strive to be virtuous, they produce a better city together – a better whole, community, a better system to live in.

Virtues are Systems Intelligence. They point the subject’s perspective and actions beyond her immediate benefit and egoistic concerns to a whole-in-the-making, with the possible outcome of contributing successfully to the workings of that whole.

The more we deal with other people in our environment without clear-cut roles and without command-and-control, and the more the innovation involves productivity-together, the more we need internal motivation. But internal motivation in an environment of co-operation and innovation, will amount to the re-emergence of virtues such as courage, moderation, wisdom, justice, generosity and friendliness.

Greed is often thought to be the key driver of market economy. We believe this emphasis is misplaced. A more sustainable basis of innovation economy is in the ancient virtues. This amounts to acknowledging others on a par with oneself and will direct focus to the whole. It is a

call for thinking that will seek creativity and innovation from communal contexts characterized by enthusiasm, joy, peer respect and strive for the meaningful. Creating such contexts, in turn, calls for Systems Intelligence.

In innovation economy, human sensitivity makes good business sense.

## Seeking an Impact on Thinking

Systems Thinking starts by viewing the environment and one's involvement with it in holistic terms. The environment and one's place in it are perceived in terms of interconnectivity and interdependence rather than separation and disconnection.

But as pointed out in the Systems Thinking literature, our conceptual apparatus, as well as our established ways of perceiving the world, are severely biased against such an approach. The temptation is to conceive the world in terms of separate "things" rather than in terms of systems and interconnections.

Systems Thinking can be defined as the theory, methodology, and practice of perceiving and operating in terms of holistic structures. Anti-reductionism and holism characterise the worldview of Systems Thinking.

The systems perspective wants to see the world as composed of systems, to examine these entities as wholes and assumes the wholes to be primary to their parts.

Yet wholes are abstractions. They are mental constructs, which are relative to the perspective adopted. As a result, there is a relativistic and perspectival undercurrent in Systems Thinking. Boundaries of a system can always be redrawn.

The human being perceives the world around herself in many ways as static and unchangeable. Systems perspective explains some of this by reference to hidden dynamic systems that generate a state of equilibrium and play down short-term change.

Systems Intelligence in the sense in which we conceive it wants to push Systems Thinking towards action and concrete, actual life. The effort could be described as follows:

- (1) Systems Intelligence follows Systems Thinking in setting out from the primacy of the whole, from acknowledging interconnectivity, interdependence and systemic feedback as the key parameters.
- (2) Like Systems Thinking, Systems Intelligence wants to account for change. Unlike Systems Thinking, Systems Intelligence involves driving change and actively embracing change.
- (3) Unlike Systems Thinking, Systems Intelligence is primarily outcome-oriented and not a descriptive effort; it is intelligence-in-action on its way to create successful systemic change.
- (4) Unlike Systems Thinking, Systems Intelligence is a capacity in the human being that involves instinctual, intuitive, tacit, subconscious and unconscious and inarticulate aspects that cannot be straightforwardly reduced to a full-fledged and transparent cognitive dimension.

Systems Thinking is an expert discipline and a field of theoretical study. The literature is often technical and thus remains inaccessible to the layman. While not dismissing the significance of such a study, our aim with Systems Intelligence is to emphasize the applicable dimension. We seek to have impact on people's thinking, and not merely to describe models of or ideals for thinking. One might observe with regret that contributions to the theoretical understanding of

Systems Thinking might not amount to any increase in Systems Intelligence, any more than contributions to academic philosophy typically result in an increase in philosophical reflection in the actual conduct of people's lives.

## Personal Mastery

Peter Senge's groundbreaking book *The Fifth Discipline* (Senge 1990) identifies five key themes as cornerstones of learning organisations:

- I. Personal Mastery
- II. Mental Models
- III. Shared Vision
- IV. Team Learning
- V. Systems Thinking.

We propose Systems Intelligence is the fundamental link between I and V. The way we see it, Systems Intelligence is Systems Thinking having become an integral part of a person's Personal Mastery. Like Senge's Personal mastery, it is about the way a person conducts her life, and at the same time, it is about Systems Thinking, i.e. the focus is on the impact and workings of the holistic and systemic structures that encompass the environment of the person.

The way we propose to interpret Senge's notion of Personal Mastery is: Personal Mastery is the ability of an individual to use her unique potentials as fully as possible to the enrichment of a good life. Thus understood, it is clear that one's ability to manoeuvre successfully in the various systems structures that constitute the environment is a key component in what Senge calls Personal Mastery.

## Mental Models

Behaviour reflects one's models of thinking and of what Senge calls "mental models". Our mental models largely determine what actions are considered necessary and possible. They are a key driver for the human being in her actions. The aphorism, "As a man thinks in his heart, so he is" highlights this familiar fact. Thinking transforms into actions, and repeated actions into habits. Eventually, thinking and habits constitute to a large extent the person's mode of being, personality and existential condition.

But as observed by Senge and others, we are mostly unaware of our mental models, i.e., the modes of thinking that govern and direct our actions.

What kind of mental models support System Intelligence? We propose that particular attention should be focused on:

- *Mental models that relate to one's self-reflective behaviour and to meta-level mental models in general:*
  - "Can I change my thinking"; "Is there a possibility that my thinking might be one-sided?"; "Where do I adopt the Advocate mode, as opposed to Inquiry mode?"; "What are my key forms of egoism that I legitimate and rationalize as unchangeable aspects of me?"
- *Mental models that relate to belief-formation:* - "How can I become more active a subject in the constitution of my beliefs"; "Why do I believe life is not all that miraculous, grand, exciting, full of opportunities?"



- *Mental models that relate to the subject's beliefs regarding the beliefs of others:* – “Could it be that she does not convey her meaning accurately in her actions?”; “Could it be that her way of talking hides her true aspirations?”; “Could it be that I am misled by appearances?”
- *Mental models that relate to co-operative possibilities:* – “Could we succeed spectacularly together?”; “Have we reached the top?”; “What would trigger excitement in others and help us create a magical uplift?”
- *Mental models that relate to possibilities of human change:* – “Could I change at the age of 52”, “Is mesmerizing love still possible as a trill after all these years”; “Is my human style fixed at the age of 40?”; “Are meetings in our company necessarily boring?”

Our beliefs reflect our experiences but are also influenced by highly idiosyncratic coincidences. Our beliefs could be something dramatically different from what they are now, had certain particular incidents not occurred. In particular, our beliefs regarding other people in our neighbourhood as well as *their* beliefs, could be different from what they are. Yet we believe, regarding our entire mental realm, that it simply mirrors the actual states of affairs.

One's beliefs might seem unchangeable and yet they can be subject to massive redefinition in an instant. You come home one day, and suddenly everything is different – because your mother has died, because you almost drove over a kid running after a football, because you have found a new love after contacting an old school mate, or perhaps because you have simply thought about the words of a familiar song with insight and sudden inspiration.

To the extent beliefs determine action, the possibility of change in beliefs amounts to a major window of opportunity of change for the individual in question. It is because of this that Systems Intelligence, as skilfulness in complex human systems environments *that always will involve beliefs*, will call for the ability to work with beliefs within oneself and in others.

Belief management and belief leadership, accordingly, will become cornerstone of Systems Intelligence. Systems Intelligent people can manage their won belief systems, the belief systems of others as well as the systems these beliefs systems together constitute, better than those low in System Intelligence.

We acknowledge three particularly critical dimensions of the Systems Intelligent belief orientation:

- Thinking (believing) about one's own thinking (and believing), and realising the opportunities therein.
- Thinking (believing) about what others are thinking (and believing), and realising the opportunities therein.
- Thinking (believing) about the interaction systems, rituals, social habits and their chains, and realising the opportunities of influencing those systems.

## Thinking about Thinking

Thinking about thinking is a meta-level capability fundamental to man as a self-corrective system.

Thinking about thinking is a key to learning Systems Intelligence. This involves the following:

- (1) Acknowledging that one's action and behaviours are a function of one's thinking (mental models, beliefs, assumptions, interpretations, etc.);

- (2) Acknowledging that one's thinking is likely to be highly idiosyncratic, one-sided, egoistical, and a far cry from an accurate, multidimensional grasp of the bigger picture; the holistic system around self is likely to be mirrored in one's thinking only partially and possibly in a highly distorted form.
- (3) In order to act more intelligently in the holistic systemic environment, I need to mirror mental models and engage in meta-level thinking regarding my own thinking, in order to change my behaviours and actions to be more in line with my true aspirations, interests and the parameters at hand, as they appear in the environment in which I operate.
- (4) One's framing of the environment and its holistic, interactive systems is likely to be severely subjected by idiosyncratic limitations. Meta-level reflection on my own framing systems is thus a particularly promising path to more intelligent behaviours in the context of such systems.

It is a well-known fact of cognitive science and creativity research that re-framing is a key to new opportunities, higher productivity and to creativity at large. Thinking about thinking is about identifying one's favoured framing patterns, challenging them and adjusting them accordingly. It is clear that the possibilities to re-frame the holistic, feedback-intensive structures around self, as well as their relation to self, are literally limitless. At the same time one is likely to have gotten stuck and stationed to some particular framing.

A Systems Intelligent person will acknowledge the limitations of her thinking and mental models particularly when it comes to conceiving the interactive environment, looking for fresh openings through challenging her own thinking.

Systems Intelligence begins when the person starts to re-think her thinking regarding her environment and the feedback structures and other systems structures of that environment.

## **We Have a Dream**

Our views might be distorted regarding our environment. Our views might be distorted regarding what people are like – team members, the boss, key customers, our spouse, our aging father.

As a result, we approach a situation from an angle that might trigger negative reactions in the other people involved. Seeing the reaction, we react accordingly. A self-maintaining and self-verifying system takes over. If nothing from outside disturbs the system, it can reach a seemingly unalterable state, and all people involved believe that their picture of each others is totally accurate – in perceiving others as fundamentally negative and down-putting. "It is a little miracle I can survive in the first place in the company of such frustrated and cynical people."

You might entertain the dream of having a totally different type of people to work with, a different spouse, and different personalities in your immediate neighbourhood. How different you could be, how much more the true yourself – so generous and so caring, so attentive and so productive – if only the others would change.

But other people around you might have exactly the same thought, the same wish, the same exact dream. In fact, this is what they are likely to have.

A major motivation for the work at hand comes from the experience of Esa Saarinen from the context of his Socratic company lectures. In the course of his hundreds of lectures and seminars for all kinds of companies and organisations for over a decade, it became apparent to Saarinen

that 95% or more of all people in any organisation want the same kind of humanly relevant qualities from their everyday – qualities pertaining to human basic behaviours such as listening, humour, empathy, presence, expressing gratitude, showing respect, etc. No matter how easy it is to generate such behaviours technically, the behaviour might get generated, due to the nature of the interaction patters of their everyday. The systems people play together, the systems they form and generate, help sustain and believe unchangeable, destroys the prospects of a good life.

*How can people get caught in seemingly unalterable systems that lead people to deliver behaviours almost nobody want?*

They make up systems that nobody wants.

It seemed appropriate to ask, how can people get caught in seemingly unalterable systems that lead people to deliver behaviours almost nobody wants and behaviours that do not reflect their own true aspirations?

This is the key question of Systems Absurdity and Systems Dictatorship as opposed to Systems Intelligence and hope.

## Seeing the Situation through the Eyes of the Other

Systems thinking starts when a person looks at the world through the eyes of another person. (C. West Churchman 1968)

Becoming aware and exploring the views of other actors and from the outside perspective is one way to enrich one's own viewpoint. Exploring the views of others is one way to grasp features of the system in a given situation, and to understand ones own input into the system.

The following techniques are likely to be of particular use for an enhancement of Systems Intelligence:

- (1) Inquiry-mode in the sense of Senge, as opposed to "advocate mode".
- (2) Dialogue techniques.
- (3) Listening to -techniques.
- (4) Facial expressions and bodily gestures that express openness and human acceptance, rather than prompt out fear.
- (5) Meta-level techniques that reinforce the subject's awareness of the interpretative nature of her images and internal representations of the people around.

Such techniques have been described in the literature intuitively and technically but notice that ultimately the question concerns the age-old human behaviours that are not technical at all. We might be able to force ourselves to see the world through the eyes of our spouse better as a result of a family therapy weekend that teaches us a "Listening to Your Lover" -technique. That escape from the current system of interaction with your spouse might be welcome but it does not change the basic fact that it is the system that counts – more so than your individual needs, aspirations and even love in your heart.

Systems Intelligence is about compassion and love that makes good pragmatic sense.

## Seeing Oneself in a System

The human experiences himself, his thoughts and feelings as something separated from the rest – a kind of optical delusion of our consciousness. (Albert Einstein, quoted in Senge 1990)

There is a difference in how people see themselves as opposed to how they see other people. We do not observe ourselves as we observe other people. We do not judge ourselves the same way as we judge others. Self-centeredness is a prominent feature of the human perceptual apparatus and of our mode of thinking.

It is this self-centeredness that Systems Intelligence tries to challenge. In Systems Intelligence

- (1) The agent perceives herself as part of a system environment, breaking away from her own limited personal perspective in favour of a more holistic perspective;
- (2) The agent, perceiving herself and her environment from a systems perspective, acts intelligently in that system.

As pointed out in Systems Thinking, cognitive science and philosophical literature repeatedly, our mental apparatus tends to want to decompose the observed reality into separate disjoint categories. Bipolar subject—object -distinction lurks deep in our conceptual apparatus.

In bipolar subject—object thinking, the person either perceives herself to be a subject that acts upon an external system, seeking to cause an impact, or else the environment as a subject acts upon her as an object. Notice that when an agent in a system (an employee or employer in a work-system, husband or wife in a marriage-system, parent or a child in an upbringing-system) perceives herself in these modes, her options of rational behaviour are immediately restricted.

In Systems Intelligence, the agent operates with a far vaster universe of options for possible behaviours:

- (1) Me as a subject operating on an object, or on another subject treated as an object.
- (2) Me as a subject reacting to having been treated as an object.
- (3) Me operating in a system with the intention to change a feature of a system.
- (4) Me and the others forming a system, with my perspective focused on changing a feature of the system, influencing others in the system, and creating a snowball effect through the leverage as created by the other agents in the system.

The child gets mad and throws herself on the floor. A High Systems Intelligence mother, instead of getting angry at her or trying to calm her down by pointed calm and rationality, also throws herself on the floor and pretends to act like a child in rage. The High Systems Intelligence mother is likely to stop the child from acting in rage. Her surprising behaviour changed the system.

A manager is not satisfied with a team member and tells about the problem. The team member reacts very negatively. The High Systems Intelligence manager listens to the angry team member and gives him an extra bonus salary citing as the reason the team member's clearly demonstrated commitment, but still confirms the need for a change.

A wife attacks her husband with frustrations that the day has generated. It seems like she is accusing him. The High Systems Intelligent husband, however, does not take the wife's words as personal criticism but perceives her need to let some steam out. With compassion, he adjusts to a productive role in a faith-in-life increasing system, as opposed to a cynicism-increasing system taking place with the couple next door.

Seeing oneself as part of a system is likely to involve the following aspects:

- (1) The impact of one's behaviours and possible changes in interaction patterns upon the behaviours and possible interaction patterns of other agents in the system.
- (2) The impact of one's behaviours and possible changes in interaction patterns upon the behaviours and possible interaction patterns of other agents in the system, as these feed back to my behaviours and possible changes in the interaction patterns.
- (3) The impact of the current system on all of us, in the long run.
- (4) The impact of one's behaviours and possible changes in the interaction patterns upon the behaviours and possible interaction patterns of the other agents in the system, as these feed back to my behaviours and possible changes in the interaction patterns, in the long run.
- (5) The modes of adjustment that I have already adopted as a result of conformity, history, established practices and unimaginative, flat thinking.
- (6) The modes of adjustment that others have already adopted as a result of their conformity, history, established practices and unimaginative, flat thinking.
- (7) The desired ideal state I would like to reach with others.
- (8) The dream we are likely to share.

## Optimism for Change

Change starts somewhere. It might emerge from something incremental, marginal, even trivial. And yet it might amount to a huge restructuring of the fundamental aspects of the entire system – because of the leverage created by

- change in the way people perceive other agents of the system as a result of a small change in the other's behaviour
- change in the way people perceive their own possibilities of acting within the system as a result of a small change in the system
- change in the way people perceive the likely structure of the system in the longer run.

When Ms Rosa Parks refused to give her seat to a white man in a Montgomery city bus in 1955, most people had not heard of Rosa Parks, considered the bus systems a technical and routine matter, did not perceive the city of Montgomery as anything particularly significant, and considered totally uninteresting the question of a particular bus seat on a particular bus leg. But as Rosa Parks was arrested the civil rights movement had reached a tipping point (Gladwell 2000) and the marginal incident caught fire, created an avalanche that eventually reached epic proportions. Change was on the way to reshaping the entire system of race distinction in the most powerful country in the world.

"The moral, rhetorical, and political brilliance of Martin Luther King, Jr.", write Paul H. Ray and Sherry Ruth Anderson in their *The Cultural Creatives* (2000), "was his ability to expose the old frames and to reframe segregation as an *American* problem." (p. 120)

Our philosophy of change is optimistic because of the overall view we have of people's beliefs. Our conviction is that many of the core beliefs of people around us do not show up in their actions as the actions reflect the assumed nature of the current system. People have adjusted to what they believe is the system – e.g. regarding "negroes". But when the system is brought to focus, the latent beliefs might trigger a revolution, spreading like an epidemic. Given a small but

critical change in the system, deeply held aspirations might suddenly leverage, adding exponentially to the momentum. Such a chance is created by the nature of beliefs and the fact that externally we must be content with the interpretations of other people who in fact might be adjusting to systems in the way they express externally their beliefs.

*Beliefs are distinctive in having a fundamentally ephemeral essence. For Systems Intelligence, this is a tremendous possibility as people's beliefs affect their actions and therefore other people.*

People might hold back, each one individually, because of a system nobody endorses.

Beliefs are distinctive in having a fundamentally ephemeral essence. They can be changed dramatically, massively, instantaneously, and with incremental input. For Systems Intelligence, this is a tremendous possibility as people's beliefs affect their actions and therefore other people.

The dominating paradigms of change conceives change in terms of notions such as

- linear cause-and-effect
- hierarchy
- control
- predictability.

*Systems Intelligence focuses on changes as leveraged by the dual force field of the human mental world and the systemic nature of life around us.* Because the system itself can change as a result of a small intervention, constrained mainly by ephemeral beliefs, there is a possibility of enormous leverage built into the systems perspective.

Systems Intelligence acknowledges that beliefs influence actions and actions influence beliefs. But *one might be massively misguided with respect to the representations of what the others truly believe.* There might be a systematic flaw in the way a group of agents perceives the way others think and what they truly want. As a result, the possibilities of co-operation among the whole group might be severely curbed as a result of the beliefs each has of the others as participants of the currently prevailing and dominating system.

Systems Intelligence is based on a principle of dynamic humbleness, which acknowledges that my perspective of others might be drastically mistaken, particularly regarding what the true aspirations of those others might be. A relatively small change, an incremental and even trivial change in my behaviour might intervene with their beliefs regarding me, and thus trigger a chain of changes in the actual behaviours in each of us and in the system we form together.

To the extent there is a veil of ignorance in our beliefs regarding the beliefs of others in the system, there also is a possibility of a cumulative enrichment and improvement. Systems Intelligence is a philosophy of realistic optimism, based on acknowledging the possibility of such an upward-spiralling movement.

This sort of leverage thinking is often bypassed. It amounts to an articulation of some of the seemingly miraculous mechanisms of actual human life. Senge (1994) for one points out in *The Fifth Discipline* that "Small changes can produce big results – but the areas of highest leverage are often the least obvious" (p. 63). The highest leverage points might indeed be hiding because they are likely to lurk in the shadows of the beliefs systems of oneself and others plus in the subtle system of interconnections we make up together.

Without going into the details, we observe that many key successes of so-called Brief Therapy (Haley 1986) and other solution-oriented forms of therapy (Baker 2003) can be understood in terms of changes in belief systems and in terms of Systems Intelligence. Similarly, Tannen's ground-breaking work on intimate communication can be understood as identifying Systems Intelligent structures in the way a couple or families communicate, and the possibilities of positive change that such a perspective opens. (Tannen 1986 and 2001) Radical changes in business logics as a result of new technologies and similar discrepancies can also be understood in systems terms.

## Changing the System

Bringing about change in a system is likely to take one of the following forms:

- Intervention or disturbance from outside (external catastrophe; major change in the market situation; the doctor's diagnosis that you have cancer, a new technology that revolutionizes a business).
- Intervention from within the system such as: the boss surprisingly stops and suddenly listens; the husband comes home and without taking his coat off, but taking his shoes off, goes immediately to hug his wife of 20 years; the CEO of a supplier calls the customer's lower level people in order to hear it straight from the front line; Richard Branson as the head of Virgin Airline greeting people on board of a routine flight to New York).
- Internal change of a relationship such as: the supplier and its customer decide to share the same physical site for their joint actions; President Nixon visits China; husband and wife agree to listen to each other for a minimum of ten minutes each day.
- Planning ahead; scenario working.
- Communication with other agents in the system.

Optimism is a cornerstone of our change philosophy due to the fact that changes in a system are often the result of a relatively small disturbance.

## Higher Order Change

In their classical work *Change*, Paul Watzlawick et al. (1974) conceptualise change in terms of a type theory. They follow the ideas of Gregory Bateson (2000) in what has become a groundbreaking work in the field of short therapy:

*"To exemplify this distinction in ... behavioural terms: a person having a nightmare can do many things in his dream – run, hide, fight, scream, jump off a cliff, etc. – but no change from any one of these behaviours to another would ever terminate the nightmare. We shall henceforth refer to this kind of change as first-order change" (Watzlawick et al. 1974, p. 10, their italics). "Waking, obviously, is no longer part of the dream, but a change to an altogether different state. This kind of change will from now on be referred to as second-order change." (p. 10–11, their italics).*

A first order change takes place within a type, while a second or higher order change takes place among alternatives each of which consists of lower order possibilities.

In many cases the first order change is superficial, illusory or non-effective. It might amount to not more than running away from the true problems at hand, and the necessary changes of a deeper level that in fact are called for.

Very often, an effective change will involve a change in the perspective regarding the way the problem is perceived, and with that will involve a shift of thinking that introduces possibilities of change of a higher order.

Similar distinction is helpful when conceptualising possible solutions to a problem one faces. A solution might be superficial and only temporarily hide the real problems, yet it might seem natural and advisable given the alternatives. We might fail to look for genuine, more productive solutions because they are situated in a box or category of a different type. We might fail to perceive them, because they might point to directions we are not accustomed to taking. They might seem to carry a cost in the short run and only pay off in the long run. They might seem counterintuitive or challenge some deeply held convictions of the given industry. They might involve us getting out of the box – the box of alternatives as they present themselves seemingly exhaustively right now.

For instance, if a person with a canoe tries to fight a strong current by struggling to slow down by sticking the paddle between the rocks, trying to choose the right rocks, the current is likely to defeat the paddler. The most successful way to paddle in a foaming current is to paddle faster than the river. But this might seem counterintuitive to a layman who reacts to speed already too high.

Systems Intelligence is about getting out of the reactive loop and onto the tracks of higher-order possibilities. A systems intelligent person acknowledges the fact that her perception of the system in which she operates might be distorted, one-sided or mistaken. She is constantly on the look-out for possible redefinition of her very perception of the system – for possibilities of a higher order.

## Explosive Possibilities of Co-operation

A person's beliefs about co-operation are a limiting factor on her conception of, perception of and success in human interaction. They limit her Systems Intelligence.

How an individual acts with other people, approaches them and frames herself and the situation are all influenced strongly by his co-operative beliefs. The urge to make room for new forms of co-operation is a major driver of Systems Intelligence.

An illustration provided by J.T. Bergqvist, a senior executive in the Nokia Corporation, will illustrate the kind of possibilities we have in mind here.

Let us consider a project team consisting of six persons. They meet in a meeting room:

1 1 1 1 1 1.

In the meeting room they interact meaning that their individual effects multiply. Let us illustrate this phenomenon or overall impact of the interaction by multiplication:

$1 \times 1 \times 1 \times 1 \times 1 \times 1 = 1.$

In real life, however, things do not work that way, given the perceptions and beliefs that people have about one another.

Let us use a story to illustrate the case. Imagine a situation where the first person to come into the meeting is a Finnish engineer, Jaska, 50 years of age. Technically a top professional but somewhat introvert and not comfortable with spoken English. As he comes in, he is thinking about Mark, 32, an Australian engineer. Like many of these Aussies in Jaska's experience, Mark is incredibly self-



assured and articulate – he speaks his own mother tongue – a tremendous man-of-the-world who believes he knows everything. Arrogant guy, Jaska finds him, a person who never listens, particularly someone like himself who is a pretty awkward with his spoken English. Jaska is put down by this advance projection, losing some of his excitement and best energy. Some 20% of his best edge is cut off and he enters the room as 0.8.

Mark is approaching the room through another corridor, already put down by what he expects the meeting to be. These Finnish guys, such a depressive lot. They might be pretty good technically but you would expect them to be able to say something without three beers. I'm tired of sitting in the saunas all the time, in order to have a discussion, Mark thinks. I try to be a little bit provocative in order to open the discussion but usually to no avail. He loses some of his best edge, say 20%, and enters the room as 0.8.

A lady is also coming in, quite feminine, a controller, who finds it irritable that she always has to act like a "tough bird". She can do it, but she loses some of her sensibilities as a result. She is a loving mother of two fabulous children but she can never talk about her children, not with these guys that act so touch and work-achievement oriented all the time. She loses some of best energies, say 20%, and enters the room as 0.8.

A senior 54-year old market guy also shows up, a bit weary because he knows what this meeting will be like. These young hungry lions. They believe they command the world. To be sure, he himself is not quite so eager to board the next plane to HK as in the old days. But you would expect there to be some respect for experience in our company. But no. He loses some 20% of his best creativity and enters the room as 0.8.

Each enters the room as 0.8. They interact as 0.8s but interaction multiplies the effects. Thus the actual outcome is

$$0.8 \times 0.8 \times 0.8 \times 0.8 \times 0.8 \times 0.8 \times 0.8 = 0.26.$$

This is a far cry from the 1 they could have achieved as an outcome. But even more, there would have been the higher-order possibility all along for Jaska the Finnish guy, when coming to the room, to think how lucky it is that Mark could make it. That guy is so quick on his feet. A tremendous articulator. He knows that when it comes to the technical side of things, I'm pretty good. Jaska the Best he calls me. And he knows I'm not that comfortable with my English language nor with situations where you have to impress a lot of other people. It's great to have Mark by my side, Jaska thinks. He enters the room as 1.2.

How lucky I am, Mark is meanwhile thinking, to have such colleagues. Colleagues such as Jaska the Best. A bit shy, Jaska is, a bit innocent even – a tremendous guy of integrity. It feels great to be able to contribute in so many ways, not only as a professional – my articulation powers are an additional bonus here, something I never thought of when working in Australia. He approaches the room as uplifted by his projection of the immediate future, getting a boost of some 20%. He is 1.2.

Each enters the room as uplifted by the projection they have of one another. They start to interact, but interaction multiplies the effects:

$$1.2 \times 1.2 \times 1.2 \times 1.2 \times 1.2 \times 1.2 = 2.98.$$

Systems Intelligence is based on the assumption that human interaction is a system of tremendous leverage, i.e. that the possibilities avoiding 0.26 and reaching 2.98 are always there, by positioning oneself not in the 0.8 but in the 1.2 mode.

But the upscale possibility what we here represent by the 1.2 mode and 2.98 outcome most often goes unnoticed. The reasons are

- People do not see themselves as contributing agents of an interactive system but they see themselves as individual agents affected and limited by others and the interaction patterns of the environment;
- People do not see themselves as contributing agents of an interactive system which could change;
- People do not perceive the way they themselves contribute to the way the prevailing system increases scepticism and lessens the possibilities of massive positive change in other people and the system;
- People do not perceive how much they could be themselves are individuals if the system would change and encourage individual growth instead of promoting systemic down playing on the individual level.

## Systems That Drive Downwards

The 1.2/2.98 mode described above is an example of an enriching system. But most human systems, and we mean this literally, work the other way, pushing people down rather than up as individuals and as group members.

How am I treated? This is a question nobody can fail to ask internally. No matter what the system, the first impression a person gets is in terms of the effects upon oneself. But

- (1) People are more sensitive to ill-treatment imposed from outside upon oneself than to the ill-treatment oneself generates upon others. It is easier to become aware of small incremental misdeed others impose on me than to become aware of the small incremental misdeed I myself do upon others. As a result, most human systems generate ill-treatment upon its members, even when no intention to that effect exists among the group members.
- (2) It is natural to assume that people are what they seem to be. If people seem inconsiderate, rude, nonattentive, unexcited, indifferent and frustrated, that is what they are. If your husband seems unromantic year after year, this is what you believe he is to the core.
- (3) It is hard for a human being to stand out for her own ways of acting and to her own principles regarding other people, if you feel alone with those ways of acting and those principles. If it is part of the culture that people come late to meetings and do not really listen to each other, it is hard to come on time and be fully attentive week after week.

A key conviction of our Systems Intelligence Theory is that all human systems have a tendency to slide towards the negative, unless a conscious and creative effort is launched to counterbalance the tendency.

Your presentation has already begun, and no sign of the boss as yet. So typical. A couple of the sales guys seem bored. So typical. You push on, you make it decently, but you realize you are 0.8. That's the way it is around here, no option for anything better.

And next time somebody else is making a presentation, you seem fairly bored.

*All human systems have a tendency to slide towards the negative, unless a conscious and creative effort is launched to counterbalance the tendency.*

The mechanism being described here is the *System of Holding Back in Return*. Systems Intelligence is based on the insight that such systems prevail everywhere, and yet do not tell the whole story. In fact, an entirely different story is hiding beneath the surface – and it could be triggered out by a marginal change. This is because most people hate the prevailing system. They just adjust to it, believing it cannot be changed.

In their view, you are one of those that support the system.

The System of Holding Back in Return is remarkably easily identified by people of various ranks and files, irrespective of age or education, Saarinen has observed in the context of his lectures. Pointing it out and naming it has often triggered astonishing change in various groups of people and organisations. It is a paradigmatic archetype of the kind of a system a Systems Intelligent person tries to challenge and change.

## Collapse of Systems Intelligence

There are a number of limitations for the growth of Systems Intelligence. The bugbears of systems intelligence include:

- (1) *Reactionary Mindset*. Notice that the Systems of Holding Back in Return is fundamentally based on reactionary modes of thought and conduct.
- (2) *Fear*. Systems Intelligence aims at growth. Fear feeds systems dictatorship and subservience to the status quo rather than creativity and co-operation.
- (3) *Static State Thinking*. The world is not a collection of individual states. The world is not static. But one's mental models, modes of thinking and talking, patterns of conceptualization and of discourses might presuppose otherwise.
- (4) *No-Growth Thinking*. If no growth is possible, no need to look for it from within or from surrounding systems of interaction and feedback.
- (5) *Mechanic Improvement Thinking*. You might focus your efforts to generate growth to technical arrangements only, thereby losing the change for super-productivity. Most management thinking falls into this category.
- (6) *Command and Control -Thinking*. If all is well already, no need to seek out fresh perspectives and avenues for growth through systemic changes in the way people interact.
- (7) *Elementalism and Individualism*. Seeing people as insulated objects narrows down perception and the space for opportunities. It leaves out human processes and wholeness, and one becomes blind to the crucial parameter of the human systems.
- (8) *Cynicism*. Systems Intelligence presupposes the possibility to improve life beyond the obvious. Perceiving the fundamental role interactive systems have in life, Systems Intelligence is a philosophy of optimism and faith in life, as opposed to cynicism, which assumes there is an upper limit to everything that can be done and to everything that people can become together.

## Minimal Input, Maximal Output

Systems Intelligence is based on the possibility of systemic change on the basis of an input, sometimes minimal input. A key question concerns the most productive forms of a systems-enhancing input.

By a systems intervention we mean an element which when introduced to a system will generate a change in the system and in its output. Our optimism concerning the possibilities of Systems Intelligence is based on the following ideas:

- (1) In most human contexts the possibility of a systems intervention is always hiding. The current system does not tell the whole story.
- (2) An intervention of potentially enormous effect can be minimal in external terms. This is because ultimately what counts is the way the intervention is interpreted in the belief systems and meaning systems of the people involved. In particular, even a minimal change might symbolize something essential, leading to a change in the interpretative perspectives of the subjects involved, and triggering an effect of potentially enormous proportions.
- (3) People adjust to systems instinctively. If a system is changed, people also change their behaviours. This leads to further change.

Notice first the highly illustrative case of New York's subway system in the later 1980s, or more generally what Gladwell (2000) calls the Broken Window Theory. The dramatic drop in New York's crime rates can be interpreted as having its origin in the small changes in the City's subway lines where a zero-tolerance approach was adopted about graffiti. Dirty cars were never mixed with clean cars. The idea was to send a message to the vandals that the system had changed. But it turned out that all kinds of other minor felonies also went down on clean cars. It is almost like a person entering a dirty subway car would enter a system that says, "You need not pay here, and please feel free to piss to the corner if the need arises". But a clean subway car is a different system.

Our assumption is that people read situations from a systemic point of view and interpret any given context in systemic terms. Then they adapt to the system. But obviously the system could be different from what people believe it to be.

As a result, there is a tremendous leverage built in any human context, if only people would interpret the system as having changed.

Here lie the chances of systemic intervention. An intervention is a change but any change is interpreted in the human context as a symbol. Therefore a clean subway car can become a powerful symbol of a new era.

The interpretation of an event, incident or a change as symbol in the human context is highly variable upon subjective, intuitive, interpretative, emotional etc. human factors. In the context of human change of the kind being discussed here, in most interesting cases, the logic is not "If X then Y". One needs to be sensitive, in order to grasp what needs to be done in order to produce a relevant outcome. It is sensitivity to such parameters that Systems Intelligence wants to highlight. As such parameters typically point beyond traditional engineering territory, Systems Intelligence extends the realm of engineering thinking considerably here. Indeed, we believe Systems Intelligence here identifies a vital connection of engineering thinking with human sensitivity.

We touch upon some fundamental existential themes. This is because the most forceful forms of intervention are likely to be ones that touch symbolically upon basic human aspirations, especially:

- (1) A subject's sense of worth and desire to be respected;
- (2) A subjects desire to feel connected to the company of others;
- (3) A subjects desire to feel connected with something meaningful.

A systems intervention that touches upon a person's basic existential needs is likely to transform into a change factor through the internal system of that person. (For a good down-to-earth discussion of the existential realm, see Koestenbaum and Block 2001.)

Consider now an example used by Saarinen in his lectures.

Most Finnish men do not buy roses for their wives on normal weekdays. A *Non-rose buying system* is in place, generating behaviours and lack of rose buying. The system is invisible however, and remains unchallenged: it is not perceived to be the reason for the actions of an individual man. Yet it is the system that decides whether a given man buys roses or not – ruling out that option. The guy himself is not consulted.

The system is in place partly because the guy himself has felt neglected for a number of years. His wife never puts lipstick for him as he comes home. No sexy underwear, either. The husband reacts to what he feels is the wife's overtly pragmatic approach to each given day. But the same is true of the wife: the two are caught in a system of mutually holding back in return and also in advance. They create a system together but soon the system takes over and reality seems to be fixed to something flat and boring, everydayish and uncreative – with no possibility to change anything, because of the way “the other one is”.

Suppose, however, the guy would one day come home with a rose and without making a number of it, would smuggle it into the bedroom, put the rose in an empty wine-bottle, leaving it there for the wife to find. Maybe that would be an opening...

For most men, if you have not already bought roses to your wife, it is difficult to start it all of a sudden. She might react negatively – because she might suspect you are trying to buy her somehow, or maybe she would be reminded of all the times she did not get the roses. In short, she might not take a sudden bucket of roses as a symbol of love or appreciation. Therefore the roses as a systems intervention might not lead to a positive change in the overall system because the intervention would not touch symbolically upon the wife's basic aspiration to feel respected.

In setting out an intervention that works, sensitivity and prudence is in order. But notice that this in itself is not news to engineering thinking to the extent *it wants to make things work and to fix whatever does not work*.

## Systems Theory and Systems Intelligence

Finally we want to relate some of the topics described above to the technical concepts and descriptions used in engineering systems theory. We feel that some of the basic systems theoretical concepts are quite useful when describing systemic phenomena and situations of the kind we are here exploring. These will also help us understand the difficulties and challenges that systems pose to us.

In systems theory a system is defined by first identifying the system inputs, i.e. the control, intervention, decision or stimulus variables and the system output variables, i.e. the responses or reactions. There can also be exogenous inputs sometimes called disturbances. An input causes the state of the system to change. The term forcing function is also used for the input (see e.g. Luenberger 1979, Rubinstein 1986).

The outputs of a system are the variables that we observe directly. The state of a system consists of the state variables representing the elements in the system. The real system and its state representation model need not to be the same. One can have many different state representations

for a given system. An element in a system can also be a subsystem. The states possess the relevant history of the system and they together with the inputs determine the future behaviour of the system.

Elements and subsystems can be interconnected in different ways. Feedback refers to a connection from an output variable to an input variable. The role of a feedback connection is often to stabilize, i.e. regulate the state and output to given desired goal values. Negative feedback acts to decrease, i.e. to stabilize, the deviations from the goal. Depending on the system structure a strong negative feedback can also result in a too strong of a corrective response, which can result in instability. Positive feedback loops reinforce deviation and act to increase deviations and are usually destabilizing but on the other hand they produce growth.

A system is adaptive if it is able to learn and accommodate changes in its parameters by itself.

Typical dynamic elements in a system represent phenomena such as time delays, integrative accumulation or the build-up of potential.

A system is controllable if we can bring it with the available control variables from one state to any other state in a finite time. A system can have subsystems or elements which are not dependent on the controls used. This means that all changes in the system state cannot be achieved by the inputs (decisions, controls, interventions) available. In an uncontrollable system the structure can be the reason for behaviour i.e. then the structure produces behaviour.

A system is observable if one can identify the state of the system in a finite time by observing the system output under changes in the input. Systems are not necessarily identifiable unless forced or disturbed with sufficiently rich inputs.

Systems can have triggering states or controls which lead to a bifurcation path with a completely new overall behaviour. Such phenomena are called chaotic. This does not need to represent chaos in the normal sense but a sudden unforeseen essential change of mode. Systems can also be trapped in limit cycles where the behaviour oscillates back and forth around a focal point.

The above described concepts may seem technical but they are directly applicable in the characterization of Systems Intelligence. The framing of a problem corresponds to the definition of the inputs, outputs and state variables. We can have different framings for the same problem. A systems intelligent person is aware of this and willing to explore the effects of changing the frame. She also recognizes that in addition to the obvious system state variables there can be important hidden ones e.g. related to the mental dynamics of the people involved. Even if a system mainly consists of human agents the overall behaviour can be determined by the seemingly invisible non-human elements included which represent active or inactive physical entities and dynamic structures such as time delays or sequential communication patterns. An example of this is the famous Beer Game used in management training (see e.g. Senge 1990).

*In most human systems and organizations the true system often includes hidden subsystems such as processes of fear or trust generation.*

A systems intelligent person is able to understand these systemic phenomena. She is aware of the fact that in most human systems and organizations the true system often includes hidden subsystems such as processes of fear or trust generation. The inputs i.e. interventions available usually control both systems. The challenge is to understand how the inputs should be used to activate all the states of the system. It is very easy to forget to use nonphysical input variables.

This is reflected in the fact that the related output, such as fear or trust, of the hidden subsystems is ignored, even if it is a major driver affecting the overall system. Thus, Systems Intelligence includes the ability to take a metalevel perspective on the inputs and interventions used. The question of observability is an important one. With partial or limited outputs one cannot always understand or see the true inner dynamics. In systems thinking vocabulary this is reflected in the saying of Churchman: Systems thinking starts when a person looks at the world through the eyes of another person. By taking a new perspective we can reveal more of the system. If we do not consider, measure or observe some factors, e.g. such psychological products as trust, then we do not know whether they are produced or not. Yet, to understand the system, it can be more important to know what is not produced than what the standard product is.

A Systems Intelligent approach acknowledges and aims to identify and understand both the visible and the invisible part of the system and control their behaviour in a positive way. An unobserved process, such as fear generation, non-support generation and similar examples, left without attention in organizations can easily steer the whole organization to a bifurcation path with chaotic or collapsing behaviour. An opposite example is the buying-of-a-rose phenomenon where a seemingly minor act, a new input signal, can move the system to a radically new, positive bifurcation path. A systems intelligent person is adaptive and sensitive to changes in her behaviour and is ready to understand changes in the structures of the system and adaptively revise her behaviour in new situations.

## Game Theory and Ecological Systems Intelligence

The theoretical models of co-operation are discussed in the literature on economics and game theory. We wish to point to this research, as the related concepts are also relevant in Systems Intelligence and can be very useful in understanding human behaviour. Human decision making does not follow the axioms of rationality assumed as the basis of economic theory. Human choice behaviour strongly reflects the decision environment and the process i.e. it is adaptive. Gains and losses are seen differently and often mechanistic optimizing is replaced by searching a goal (see e.g. Newell and Simon 1972, Kahneman and Tversky 2000). These phenomena are studied under the term Bounded Rationality (see e.g. Gigerenzer et al. 1999, Simon 1982, 1997). People are postulated to possess an adaptive toolbox of ecological rationality for tackling complex problem solving and decision making situations (see Gigerenzer 2000, Gigerenzer and Selten 2001). We see Systems Intelligence as one basic human capacity, a form of ecological rationality, in such an adaptive toolbox.

Game theory studies decision making behaviour in situations where two or more decision making agents are interacting. Systems, which consist of independent goal seeking agents, can be described by game settings. The overall behaviour depends on the form of agent interaction. When each agent always reacts by one-sided optimization the result is the generation of a prevailing myopic non-cooperative Nash equilibrium. It becomes the local status quo an escape from which is not possible by self-interested rationality. This is the case in the famous problematic phenomenon and paradox of game theory called Prisoner's Dilemma. In this situation the agents end up in an inferior non-co-operative equilibrium solution even if a jointly dominating solution would also be available by co-operation. This reflects the system of holding back discussed earlier in this paper. However, evolutionary processes as in biological and human systems do exhibit the spontaneous emergence of the evolution of co-operation generating superior dominating overall behaviour for all the actors (Axelrod 1984, Gintis et al. 2003). This can be interpreted as a manifestation of ecological Systems Intelligence. A system can also include a coordinator or an organizational structure which is able to introduce rules, explicit or tacit, or interaction mechanisms to induce co-operation by incentives. Such incentives which are conditional on the

actors' own behaviour can reflect organizational Systems Intelligence as they can produce stable self enforced co-operation. Human organizations and societies have done this by means of e.g. social and moral rules with sharing and positive reward mechanisms. For related literature see e.g. Simon 1980, Maynard Smith 1982, Axelrod 1984, Fiske 1993, Bateson 2000, Smith 2000, Gigerenzer and Selten 2001, Gintis et al. 2003.

## Conclusion

In this paper we have indicated some fundamental characteristics of Systems Intelligence. We believe that Systems Intelligence is a key form of human behavioural intelligence. We hope to have demonstrated that this concept is useful for understanding a number of fundamental, interrelated, yet seemingly distinct phenomena. Also, we hope to have shown that the concept of Systems Intelligence is highly intuitive and that it therefore is potentially applicable for practical purposes. The other essays in this volume also demonstrate the variety of contexts where the concept is useful. We hope the present volume will stimulate further research, as well as practical applications, in fields such as education, organizational life, leadership, personal growth, counselling, cultural studies, anthropology, law, etc. The Systems Intelligence web site will provide access to our future work in this area and links to other related sites.

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