Systems Thinking and Wicked Problems

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Aalto University and the International Society for the Systems Sciences
Tongji Huangpu School
November 20, 2017
Agenda

1. A personal system

2. Systems thinking – basic language

3. Wicked problems
David Ing, Professional Experience

**IBM Canada / North America**
(1985-2012; retired early)
Management consultant; market development; marketing scientist

**Aalto U.**
(2003-)
Since 2010, teaching in master's program in Creative Sustainability

**U. of Toronto**
Canadian Centre for Marketing Information Technologies (C²MIT)
(cofounder 1990-1992)

**International Society for the Systems Sciences**
(President 2011-2012)
Born 1914
樓崗（開平）
Lougang (Kaiping)
Ancestral village Nanyang

Moved 1928 (age 14)
Orangeville, Ontario
Sponsored by uncle to work in laundry

First son born 1932
Ing Hon Keong
Ancestral village Nanyang

Moved 1952
Gravenhurst, Ontario
Bought and operated Queen’s Cafe

Daughter born 1951
Pearl Ing

Join in 1949
Toronto, Ontario
by eldest son Ing Hon Keong (age 16)

Join in 1950
Toronto, Ontario
by wife Lee Toy Ping + 2nd son Harry Ing (age 9)
Married 1954
Gravenhurst, Ontario
Lee Suey Chee (Violet)

Daughter born 1956
Gravenhurst, Ontario
Jeanne Ing

Son born 1957
Gravenhurst, Ontario
David Ing

Son born 1961
Gravenhurst, Ontario
Benjamin Ing

Canada recognizes PR Chinese 1970
Chinese National Table Tennis team visits Gravenhurst, Ontario 1972
Birthplace of 白求恩
Dr. Norman Bethune

Ing Hon Keong (Kent)
(my father)
Family in Nanyang (2013)
What is the most important decision of your life?

In the past, a person’s status was largely determined by where he or she was born.

Today, location constitutes an additional divisive line that separates the have-nots, along race, education, occupation and income.

In today’s highly mobile and interconnected society, one’s life chances are significantly affected by the ability to move and relocate as well.

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Systems thinking is a perspective on wholes, parts and their relations.

Function (non-living) or role (living)

containing whole

- **Function**: “contribution of the part to the whole”
- **Structure**: “arrangement in space”
- **Process**: “arrangement in time”

In authentic systems thinking, synthesis precedes analysis and the containing whole is appreciated.

<table>
<thead>
<tr>
<th>Synthesis precedes analysis</th>
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<tbody>
<tr>
<td>1. Identify a containing whole (system) of which the thing to be explained is a part.</td>
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<td>2. Explain the behavior or properties of the containing whole.</td>
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<td>3. Then explain the behavior or properties of the thing to be explained in terms of its role(s) or function(s) within its containing whole.</td>
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Pacing layers emphasize coevolution and learning

SITE
This is the geographical setting, the urban location, and the legally defined lot, whose boundaries outlast generations of ephemeral buildings. "Site is eternal", Duffy agrees.

STRUCTURE
The foundation and load-bearing elements are perilous and expensive to change, so people don't. These are the building. Structural life ranges from 30 to 300 years (but few buildings make it past 60, for other reasons).

SKIN
Exterior surfaces now change every 20 years or so, to keep up with fashion or technology, or for wholesale repair. Recent focus on energy costs has led to re-engineered Skins that are air-tight and better-insulated.

SERVICES
These are the working guts of a building: communications wiring, electrical wiring, plumbing, sprinkler system, HVAC (heating, ventilation, and air conditioning), and moving parts like elevators and escalators. They wear out or obsolesce every 7 to 15 years. Many buildings are demolished early if their outdated systems are too deeply embedded to replace easily.

SPACE PLAN
The interior layout, where walls, ceilings, floors, and doors go. Turbulent commercial space can change every 3 years; exceptionally quiet homes might wait 30 years.

STUFF
Chairs, desks, phones, pictures; kitchen appliances, lamps, hair brushes; all the things that twitch around daily to monthly. Furniture is called mobilia in Italian for good reason.

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The essential idea of a pattern language is: a solution to a problem in context

Every time a designer creates a pattern (or, for that matter, entertains any idea about the physical environment), he essentially goes through a three-step process.

He considers a PROBLEM, invents a PATTERN to solve the problem, and makes mental note of the range of CONTEXTS where the pattern will solve the problem. […]

The format says that whenever a certain CONTEXT exists, a certain PROBLEM will arise; the stated PATTERN will solve the PROBLEM and there should be provided in the CONTEXT.

While it is not claimed that the PATTERN specified is the only solution to the PROBLEM, it is implied that unless the PATTERN or an equivalent is provided, the PROBLEM will go unsolved (Alexander, Ishikawa, & Silverstein, 1967, pp. 1–4).


There are at least ten distinguishing properties of planning-type problems, i.e. wicked ones .... We use the term “wicked” in a meaning akin to that of “malignant” (in contrast to “benign”) or “vicious” (like a circle) or “tricky” (like a leprechaun) or “aggressive” (like a lion, in contrast to the docility of a lamb). [.....]

1. There is no definitive formulation of a wicked problem ....
2. Wicked problems have no stopping rule ....
3. Solutions to wicked problems are not true-or-false, but good-or-bad ....
4. There is no immediate and no ultimate test of a solution to a wicked problem ....
5. Every solution to a wicked problem is a "one-shot operation"; because there is no opportunity to learn by trial-and-error, every attempt counts significantly ....
6. Wicked problems do not have an enumerable (or an exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan ....
7. Every wicked problem is essentially unique ....
8. Every wicked problem can be considered to be a symptom of another problem ....
9. The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem's resolution ....
10. The planner has no right to be wrong ....

[In the 1950] psychophysics of perception … "givens" in the light to the eye could not support perceptual phenomena, but only elementary experiences such as sensations. […] Succinctly put, the psycho-physical program was … traditional in considering perception to be a set of responses to presented stimuli (albeit "higher order" stimuli).

Over the last 10-15 years [James J. Gibson] has tried to develop enough theory … to demonstrate that direct perception is indeed plausible even if hordes of difficult details remain to be worked out. The … analysis of the optic array, stimulus organization, and the functional organization of perceptual systems are what Gibson oftens points to as radical features …. 

How do we recognize a living system? As (a) the being of an organism; or (b) an animate becoming?

I have folded the organism in on itself such that it is delineated and contained within a perimeter boundary, set off against a surrounding world – an environment – with which it is destined to interact according to its nature. The organism is ‘in here’, the environment ‘out there’.

In this depiction there is no inside or outside, and no boundary separating the two domains. Rather there is a trail of movement or growth. Every such trail discloses a relation. But the relation is not between one thing and another – between the organism ‘here’ and the environment ‘there’. It is rather a trail along which life is lived. Neither beginning here and ending there, nor vice versa ....

How do we interpret a line? As (a) a static perimeter; or (b) a trajectory of movement?

For the Inuit, as soon as a person moves he becomes a line.

… lineal movement *along* paths of travel [is] referred to ... as wayfaring.

… lateral movement *across* a surface, ... I call transport.

My contention is that lives are led not inside places but through, around, to and from them, from and to places elsewhere ....

Human existence ... unfolds not in places but along paths. Proceeding along a path, every inhabitant lays a trail.

How are lives lived? As (a) a network of connected points; or (b) a meshwork of entangled lines?

The lines of a network, in its contemporary sense, join the dots. They are connectors.

The lines of the meshwork are the trails along which life is lived.

What is learning? (a) transmission of representations; or (b) an education of attention?

The maze … offers not one path, but multiple choices, of which each may be freely made but most lead to dead ends. It also differs, however, in that its avenues are demarcated by barriers which obstruct any view other than straight ahead. The maze does not open up to the world …, it encloses, trapping its inmates within the false antimony of freedom and necessity.

In walking the labyrinth, by contrast, choice is not an issue. The path leads, and the walker is under the imperative to go where it takes him. But the path is not always easy to follow. …. The danger lies not in coming to a dead end, but in wandering off the track. …. You are, rather, fated to carry on nevertheless, along a path that, if you are not careful, may take you ever further from the living, to whose community you may never make it back.

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