Systems Thinking, Systems Design -- Course Introduction

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isss.org/1998meet/meeting.htm

The 42nd Annual Conference

of the

International Society for the Systems Sciences

July 18 - 25 1998,

Held at Georgia Tech

Atlanta Geogia

International Society for the Systems Sciences

Conference Summary

isss.org/98transc/indx1998.htm

Rough Transcriptions of Plenary Sessions (and some Paper Sessions)

at the ISSS 1998 Conference

The following notes, typed (in real time) during the presentations, are an approximate reflection of what was said (at least formally) at the 1998 ISSS Conference, in the plenary sessions, and some of the paper sessions.

Welcomes (Monday, July 20, 1998)

Plenary Sessions

Monday, July 20, 1998

Plenary session

- System science today and its contribution to sustainable technology (Mike C. Jackson)
- Technological sustainability and industrial progress (Bill Shireman)

Plenary session: "Systems science: Bridging specialties for sustainable technology.

- LST: Bridging the biological and social sciences (Jim Miller)
- Systems thinking -- Inquiry across philosophy, science, arts, and humanities (Russell Ackoff)
- The intellectual technology of guiding societal evolution (Enrique Herrscher)

Tuesday, July 21, 1998

Plenary session: Ecological sustainability through advancing technology

- Ecological sustainability through advancing technology (Eugene Odum)
- Supply side sustainability: A hierarchical theoretical model for incorporating technology (Timothy F. H. Allen)
- Advancing human cognition through technology: The impact of writing on civilization (Denise Schmandt-Besserat)

Plenary session: Economic sustainability and systems thinking

- Economic sustainability through systems education (Len Troncale)
- Ecological sustainability through alternate energy technologies (Helmut Burkhardt)

Wednesday, July 22, 1998

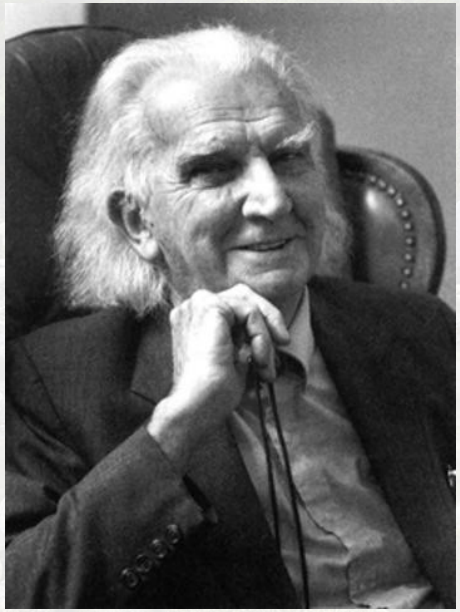
Plenary session: Sustainable technology in social systems

- Sustainable technology in social entropy theory (Kenneth Bailey)
- A profile on R&D on sustainable technology (Alan Porter)
- General systems theory and peace (Anatol Rappaport)

Plenary session: Sustainability and supranational systems

Heritage of the systems movement from 1954

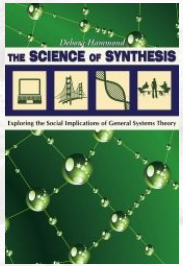
Ludwig von Bertalanffy
(biology, general systems theory)



Kenneth Boulding
(economics, peace studies)

Ralph Gerard
(neurophysiology, behavioral sci.)

Anatol Rapoport
(math. psychology,game theory)



Mutual interest in theoretical frameworks

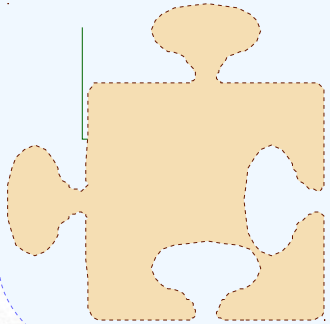
- Systems: physical, technological, biological, social, symbolic
- Interdisciplinary research: a general theory of complex systems

[Hammond 2003, p. 9]

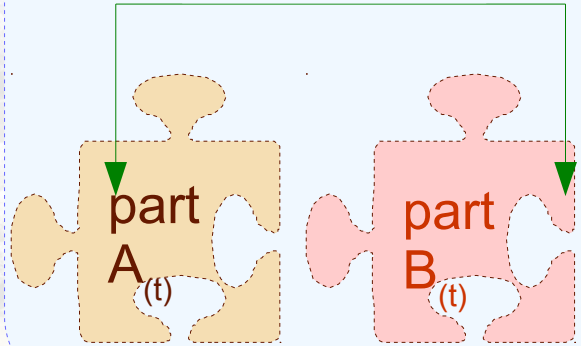
Systems thinking is a perspective on wholes, parts and their relations

containing whole

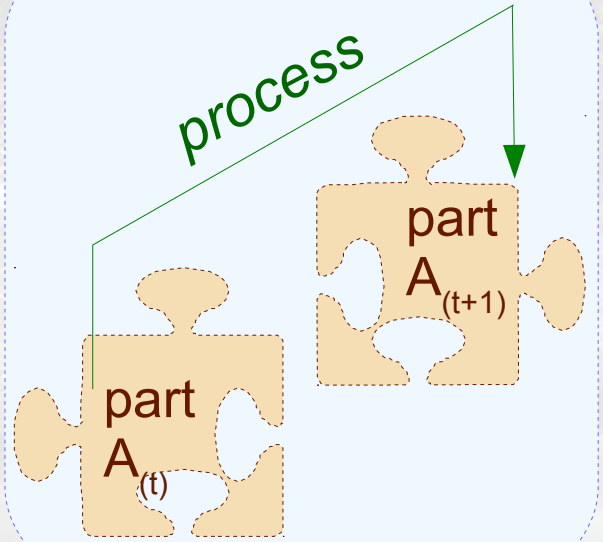
Function (non-living) or role (living)



structure



process



Function
"contribution of the part to the whole"

Structure
"arrangement in space"

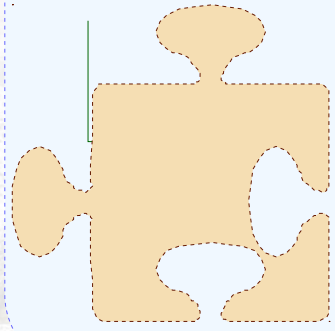
Process
"arrangement in time"

Source: Ing, David. 2013. "Rethinking Systems Thinking: Learning and Coevolving with the World." *Systems Research and Behavioral Science* 30 (5): 527–47. doi:10.1002/sres.2229. Gharajedaghi, Jamshid. 1999. *Systems Thinking: Managing Chaos and Complexity: A Platform for Designing Business Architecture*. Elsevier. http://books.google.ca/books?id=7N-sFxFntakC .

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

containing whole

Function (non-living) or role (living)



Synthesis precedes analysis
1. Identify a containing whole (system) of which the thing to be explained is a part.
2. Explain the behavior or properties of the containing whole
3. Then explain the behavior or properties of the thing to the explained in terms of its role(s) or function(s) within its containing whole.

Source: Ackoff, Russell L. 1981. *Creating the Corporate Future: Plan or Be Planned For. New York:* John Wiley and Sons. http://books.google.com/books?id=8EEO2L4cApsC.

Pacing layers emphasize coevolution and learning

SITE

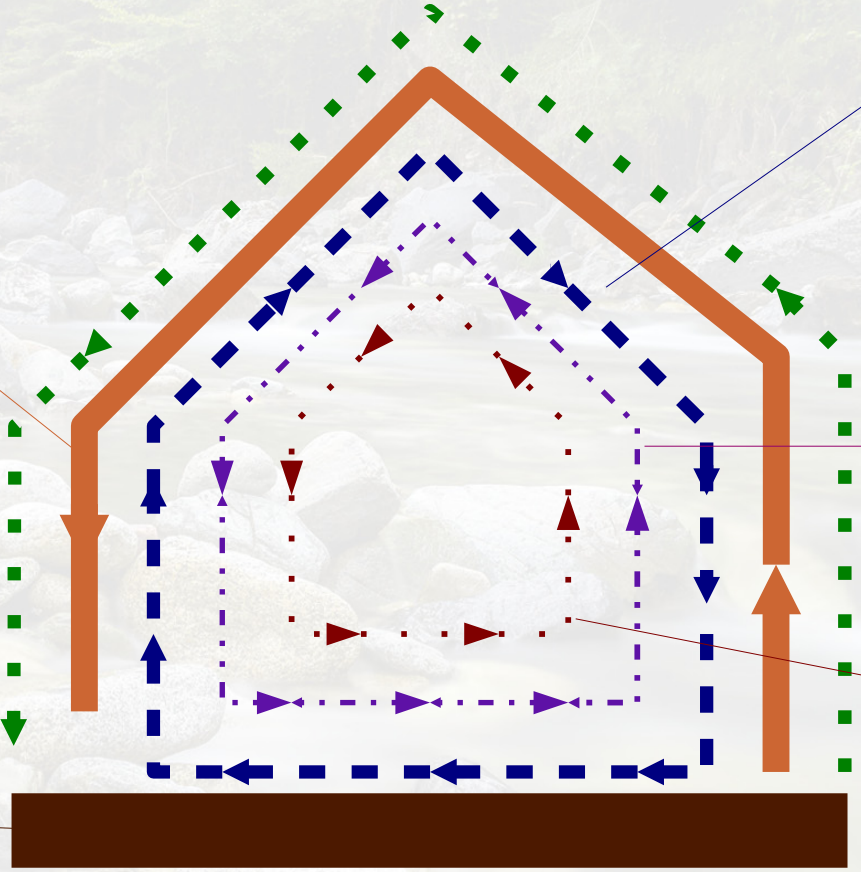
This is the geographical setting, the urban location, and the legally defined lot, whose boundaries outlast generations of ephemeral buildings. "Site is eternal", Duffy agrees.

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.

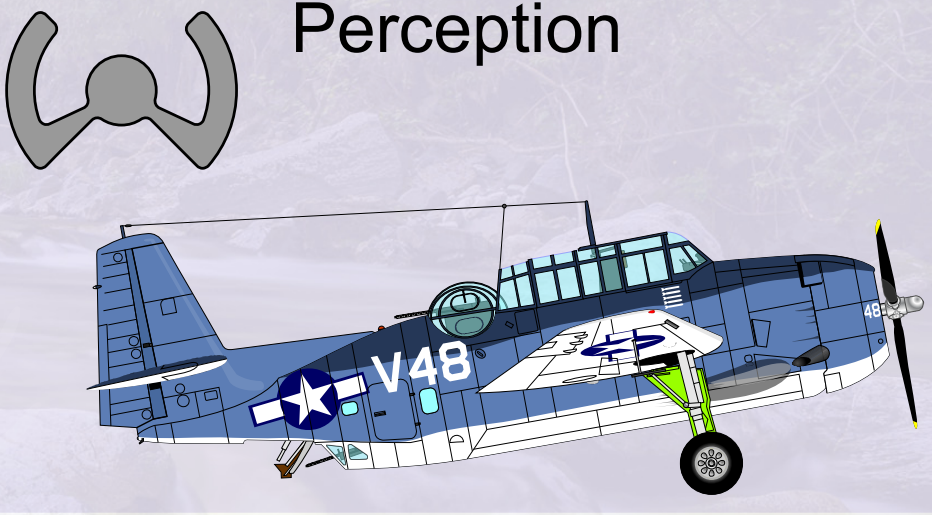
Source: Stewart Brand. 1994. *How Buildings Learn: What Happens after They're Built*. New York: Viking.

Ask Not What's Inside Your Head, but What Your Head's Inside of

Stimulus – Response
(Behavioral Psychology)

[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).

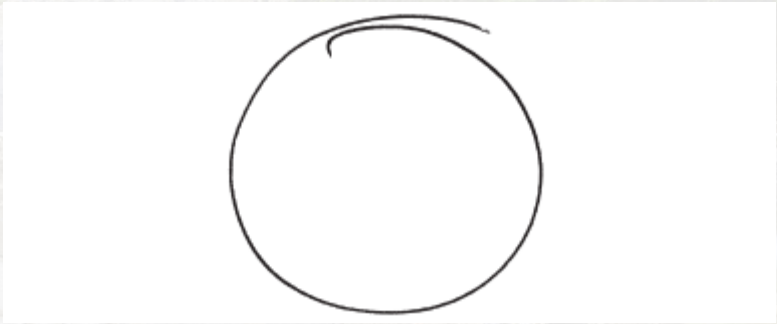
Ecological Approach to Perception



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 ….

William M. Mace 1977. "James J. Gibson's Strategy for Perceiving: Ask Not What's inside Your Head, but What Your Head's inside of." In *Perceiving, Acting, and Knowing: Toward an Ecological Psychology*, edited by Robert Shaw and John Bransford, 43–65.

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

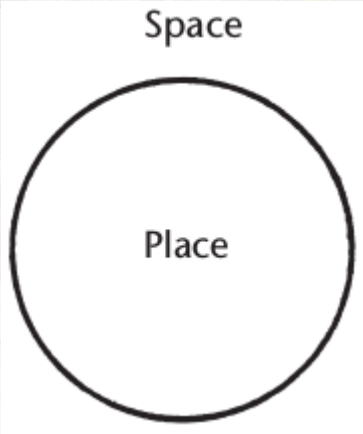


I have folded the organism in on itself such that it is delineated and contained within a perimeter boundary, set off against a surrounding world – an environment – with which it is destined to interact according to its nature. The organism is ‘in here’, the environment ‘out there’.

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 ….

Tim Ingold. 2011. “Rethinking the animate, reanimating thought.” In *Being Alive: Essays on Movement, Knowledge and Description,* p. 69.

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



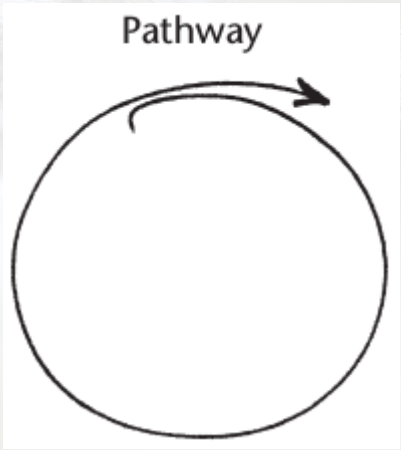
For the Inuit, as soon as a person moves he becomes a line.

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

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

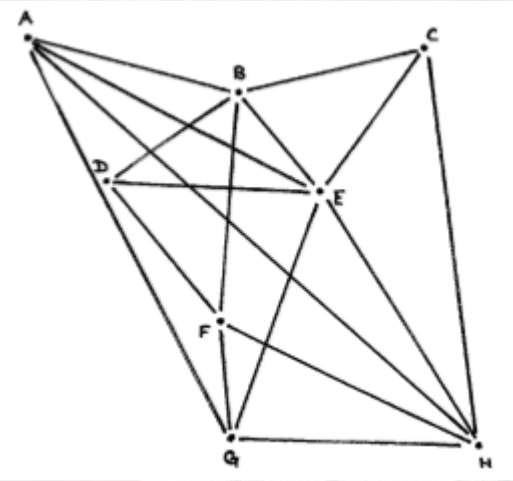
My contention is that lives are led not inside places but through, around, to and from them, from and to places elsewhere ….

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

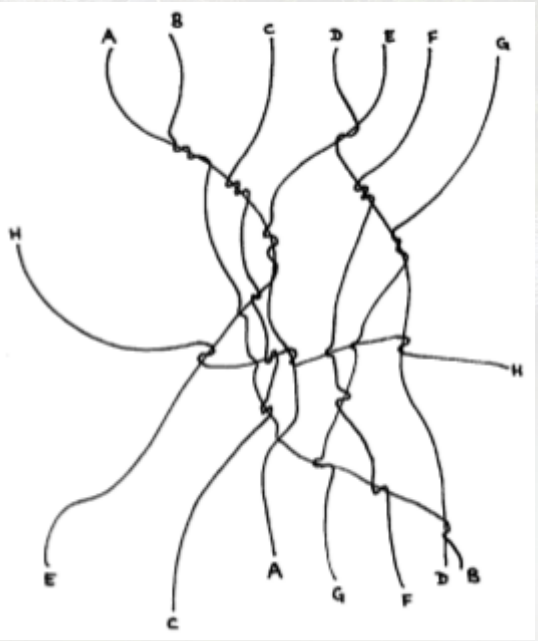


Tim Ingold. 2011. "A storied world." In *Being Alive: Essays on Movement, Knowledge and Description,* p. 148-149.

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.

Tim Ingold. 2007. “Up, across and along.” In *Lines: A Brief History,* p. 80-82.

Defining systems science(s) → science?

Primary intellectual virtue:	**Episteme**	**Techne**	**Phronesis**
Translation / interpretation:	Science (viz. epistemology)	Craft (viz. technique)	Prudence, common sense
Type of virtue:	Analytic scientific knowledge	Technical knowledge	Practical ethics
Orientation:	Research	Production	Action
Nature:	Universal	Pragmatic	Pragmatic
	Invariable (in time and space)	Variable (in time and space)	Variable (in time and space)
	Context-independent	Context-dependent	Context-dependent
Pursuits:	Uncovering universal truths	Instrumental rationality towards a conscious goal	Values in practice based on judgement and experience
Colloquial description:	**Know why**	**Know how**	**Know when, know where, know whom**

David Ing. 2013. "Rethinking Systems Thinking: Learning and Coevolving with the World." *Systems Research and Behavioral Science* 30 (5):527–47.

Paths to develop systems thinking

Episteme (e.g. theoretical science, codified principles)	**Techne** (e.g. methods and techniques, collaboration)	**Phronesis** (e.g. hands-on experience, values in practice)	*Proposed path for learning and coevolving*	*Case domains*
☐ (weak)	✔ (strong)	✔ (strong)	Induction: **Why** are the natures or behaviours of systems similar or dissimilar?	Service systems?
✔ (strong)	☐ (weak)	✔ (strong)	Abduction: **How** are future systems to be developed or improved over current systems?	Ecosystems?
✔ (strong)	✔ (strong)	☐ (weak)	Deduction: **When, where** and for **whom** are systems material and/or salient?	Governing / policy systems?

Systems Thinking Ontario

Upcoming Meetings

2018-01-17
2018-02-21
2018-03-21
2018-04-18
2018-05-16
2018-06-20
2018-07-18
2018-08-15
2018-09-19
2018-10-17
2018-11-21

Past Meetings

2017-11-15
2017-10-18
2017-09-20
2017-08-16
2017-07-19
2017-06-21
2017-05-17
2017-04-19
2017-03-15
2017-02-15
2017-01-18
2016-11-16
2016-10-19
2016-09-21
2016-08-17
2016-07-20

HOME

Systems Thinking Ontario is an transdisciplinary group centered in Southern Ontario, with the premise that members might be within driving distance of Toronto, and might meet face-to-face. Think global, act local!

This public wiki (at http://wiki.st-on.org, or https://sites.google.com/site/systhinkon/) is a companion to the DISCUSSION GROUP at https://groups.google.com/d/forum/st-on (or shortcode http://bit.ly/st-on).

Our working definition of systems thinking is: understanding the world by exploring parts and wholes. We do this by simultaneously and iteratively using analysis (what parts does this whole contain) and synthesis (which wholes contain this part). For an opinion (not necessarily definitive) of the domain of interest, see "An Interview on Service Systems, Natural Systems", and systems sciences.

Upcoming meetings are listed in the sidebar navigation along with links to past meetings.

Some related local activities on Systems Thinking include:

- The Strongly Sustainable Business Model Group, in the OCADU Strategic Innovation Lab (connected with the Strategic Foresight and Innovation program)
- DGC2003: Systems Thinking for Global Problems, part of the Dynamics of Global Change Collaborative Program at U. of Toronto, May-June 2012;
- The Faculty of Environmental Studies, at York University; and
- The Sustainability Management program, in the G. Raymond Chang School of Continuing Education at Ryerson University.

Systems Thinking Ontario could become a chapter of the International Society for the Systems Sciences ... if the members decided that the group should do that. The most recent meeting of the ISSS in Ontario was at Waterloo 2010, preceded by Toronto 2000.

Artifacts from ISSS San Jose 2012 at available at http://isss.org/world/sanjose-2012-retrospective. Audio and video are accessible from http://media.isss.org , http://www.youtube.com/user/systemsmovement and http://itunes.apple.com/ca/podcast/isss-conference-audio/id552809318 . Remember that the primary intent of the group is, however, that we should meet face-to-face, upon occasion.

Systems Thinking Ontario is a spin-off from the Design With Dialogue community. The spirit of collaboration and open sharing aspires to the be same. The format and

Organizations embark on *open innovation* initiatives to sweep in external knowledge, practices and resources in cooperation with partners. This contrasts to the mainstream *private innovation* approach of in-house research and development sponsored solely by an incorporated funder, with intellectual property protected by copyright. Few organizations simultaneously engage in both approaches, within and across the levels of programs, projects and individuals. How does *learning* occur in such an organization -- and the communities of members within the organization -- in both cumulative and distributed ways?

The *open innovation learning* exhibited by IBM in the decade of 2001-2011 provides a foundation for building both descriptive theories and normative theories. Legal protocols for *open source* licensing began in 1998, and "open innovation" became popular in the business press from 2003. At the beginning of the 2001-2011 period, a behaviour of *open sourcing* by commercial enterprises departed from a tradition of *private sourcing* that presumes trade secrets for competitive advantage that maintaining economic viability. After a decade, *Open Sourcing while Private Sourcing* (*OSwPS*) had been demonstrated as a successful way of doing business at IBM, and had also become adopted by other companies and institutions.

The primary method employed to appreciate the phenomenon of OSwPS is multiparadigm inquiry. Theories are developed inductively from seven case studies, characterized in five containing contexts over the period, in a process orientation observing events, activities and choices ordered over time. Three descriptive theories have been built in parallel perspectives based on contrasting philosophies. Pursuit of a normative theory subsequently led to the proposal of additional hypotheses.

Emerging theories of open innovation learning challenge a presumption that commercial and non-commercial interests are incompatible. Open sourcing *while* private sourcing is a demonstrable way of conducting a viable business.

David Ing is a cofounder of the *Trito Innovation Colab*, centered in Toronto, Canada. An alumnus of IBM after 28 years, this research was conducted during doctoral studies of the *Aalto University School of Science* in Finland. He received a master's degree from the *Kellogg School of Management* at *Northwestern University*, and a bachelor's degree from *Trinity College* at the *University of Toronto*. He has served as president of the *International Society for the Systems Sciences*, and is an ambassador for the *International Society of Service Innovation Professionals*.

Jim Spohrer is a Director of the IBM Cognitive Opentech Group at *IBM Research Almaden*, in San Jose, California. Previously, he was Director of IBM Global University Programs, a cofounder of the Almaden Services Research group, and the founding CTO of IBM's Venture Capital Relations Group in Silicon Valley. He has a Ph.D. in artificial intelligence from *Yale University*, and a bachelor's degree in Physics from *MIT*.

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Open Innovation Learning

Theory building on open sourcing while private sourcing

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Foreword by Jim Spohrer

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