Innovation Learning for Sustainability

What is smarter for urban systems?

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Aalto University and Trito Innovation CoLab

http://coevolving.com

International Conference on Smart Cities and Urban Design

April 21, 2018

Wuhan, PR China

Agenda

1. Smarter Systems

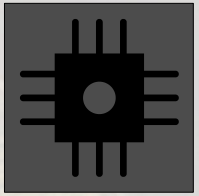
2. Sustainability +
   Service Systems Science

3. Innovation Learning

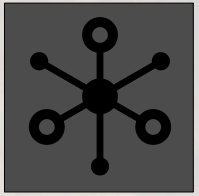
From 2008, smarter planet ≡ sensors + Internet + analytics

Converging physical and digital infrastructure

Our world is becoming **INSTRUMENTED**



Our world is becoming **INTERCONNECTED**

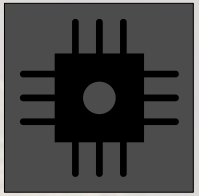


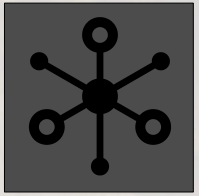
Virtually all things, processes and ways of working are becoming **INTELLIGENT**

Ing, David. 2008. “Converging digital and physical infrastructures: instrumented, interconnected, intelligent.” *Coevolving innovations* (blog), November 6. http://coevolving.com/blogs/index.php/archive/converging-digital-and-physical-infrastructures-instrumented-interconnected-intelligent/

Infrastructure that was unobservable → observable

Pre-digital physical infrastructure	***Converging physical and digital infrastructure***
World as invisible or unobserved	Our world is becoming **INSTRUMENTED**
Analog/synchronous connections, person-to-person and machine-to-machine	Our world is becoming **INTERCONNECTED**
Things as dumb or unresponsive to interaction	Virtually all things, processes and ways of working are becoming **INTELLIGENT**





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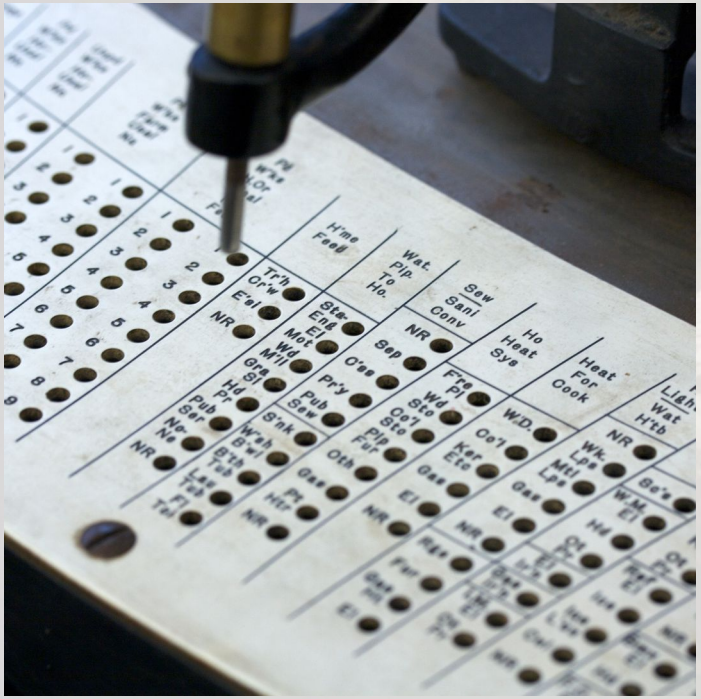
Infrastructure advances: Tabulating → Automating → Co-responding



The Tabulating Era (1900s-1940s)

- Single purpose mechanical systems

The Programming Era (1900s-today)

- If / then logic and loops, instructions coded in software

The Cognitive Era (2011 →)

- Man-machine symbiosis in cooperative interactions (Licklider)

Kelly, John E. 2015. “Computing, Cognition and the Future of Knowing.” *IBM Research and Solutions Portfolio*. Somers, NY: IBM. https://www.research.ibm.com/software/IBMResearch/multimedia/Computing_Cognition_WhitePaper.pdf.

Lifelines co-respond with habit, agencing, and attentionality

Habit, rather than volition:

I become my walking, and that my walking walks me. I am there, inside of it, animated by its rhythm. And with every step I am not so much changed as modified, in the sense not of transition from one state to another but of perpetual renewal. [p. 16]

Agencing, rather than agency:

Interaction goes back and forth as agents, facing each other on opposite banks of the river, trade messages, missiles, and merchandise. But to *correspond*, in my terms, is to join with the swimmer in the midstream. It is a matter not of taking sides but of going along. [p. 18]

Attentionality, rather than intentionality:

Walking calls for the pedestrian's continual responsiveness to the terrain, the path, and the elements. To respond, he must attend to these things as he goes along, joining or participating with them in his own movements. [p. 19]

Ingold, Tim. 2017. "On Human Correspondence." *Journal of the Royal Anthropological Institute* 23 (1):9–27. https://doi.org/10.1111/1467-9655.12541.

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Trees have a “first life”, and then a “second life” with Kii foresters

So, the ***first life*** is when the tree is growing in the ground, and when and you’re looking after it. The ***second life*** is when the tree is in your house and it’s looking after you. That also lasts about 30 years during which time you’ve planted a new set of trees. They’ll be harvested and they’ll replace the old timbers as they begin to go rotten.

Perhaps, by that stage — and so that way — you’ve got a perfect interlocking of tree lasting and human lasting — that is, **tree life cycles, and human life cycles** — that are kind of in phase with one another, and carrying on indefinitely through time.

Ingold, Tim. 2016. “The Sustainability of Everything.” *Centre for Human Ecology*, Glasgow, Scotland, September 10; Knight, John. 1998. “The Second Life of Trees: Family Forestry in Upland Japan.” In *The Social Life of Trees: Anthropological Perspectives on Tree Symbolism*, edited by Laura M. Rival, 197–218. Oxford, UK: Berg.

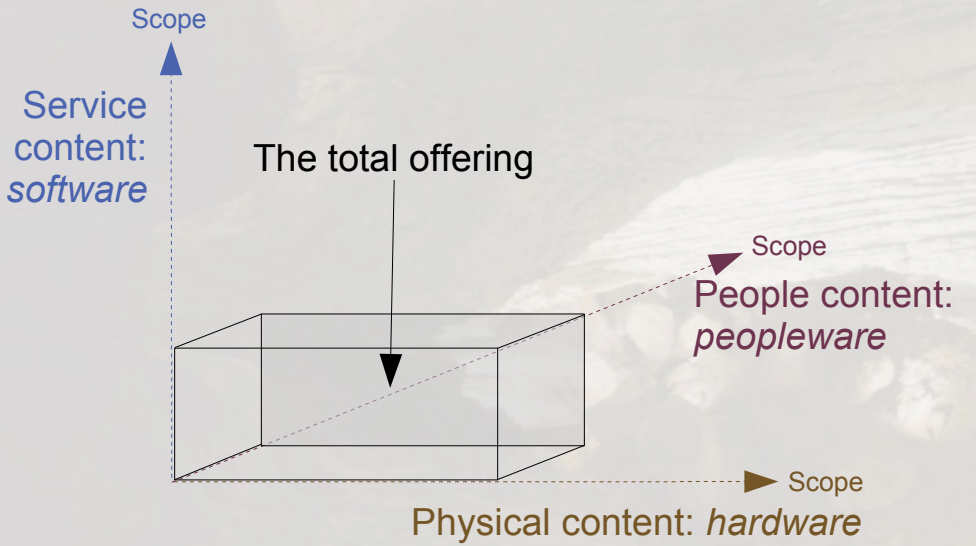
Sustainability is not preserving form, but continuing life cycles

That was all fine, until the **conservationists** came along and said **you can't cut those trees!** These trees are part of nature! We need to preserve nature! So they denied the trees the possibility of their second life. They just stood there getting older and older in the ground, until they eventually drew out, as conifers do, sort of died down. They died on their legs, and died in their roots, and **became dead trees** standing in the ground.

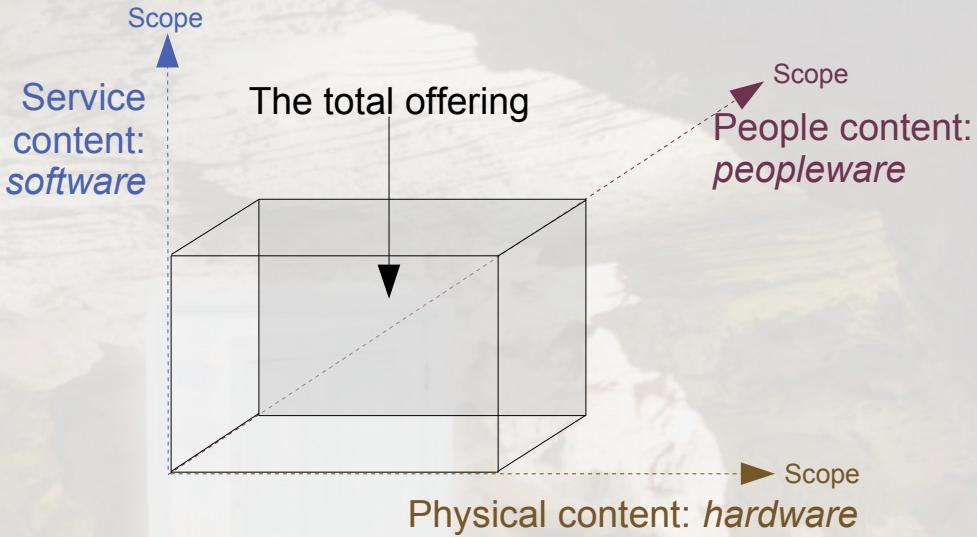
And the foresters didn't have the raw materials to build and restore their houses. So what happens now is we have **ancient trees** and **concrete houses**, in the name of preservation, and thinking of sustainability in terms of the **preservation of form**, rather than the **continuation of life cycles**.

Ingold, Tim. 2016. "The Sustainability of Everything." *Centre for Human Ecology*, Glasgow, Scotland, September 10; Knight, John. 1998. "The Second Life of Trees: Family Forestry in Upland Japan." In *The Social Life of Trees: Anthropological Perspectives on Tree Symbolism*, edited by Laura M. Rival, 197–218. Oxford, UK: Berg.

Offerings are interactions that provide benefits in the form of (i) physical products, (ii) service and infrastructure, and (iii) interpersonal relationship



General Motors has historically been more **transaction focused**, and long-lasting relationships have not been seen as a worthwhile goal.



Toyota tries to develop **long-term partnerships** with its suppliers

Rafael Ramirez and Johan Wallin. *Prime Movers: Define Your Business or Have Someone Define It Against You*, 2000, p. 50.

An offering can be an output, an input or a co-creation

Offerings-output production

- Providers fix bundles of offerings from which customers select

Offerings-input coproduction

- Customers broaden the range of options through loose coupling

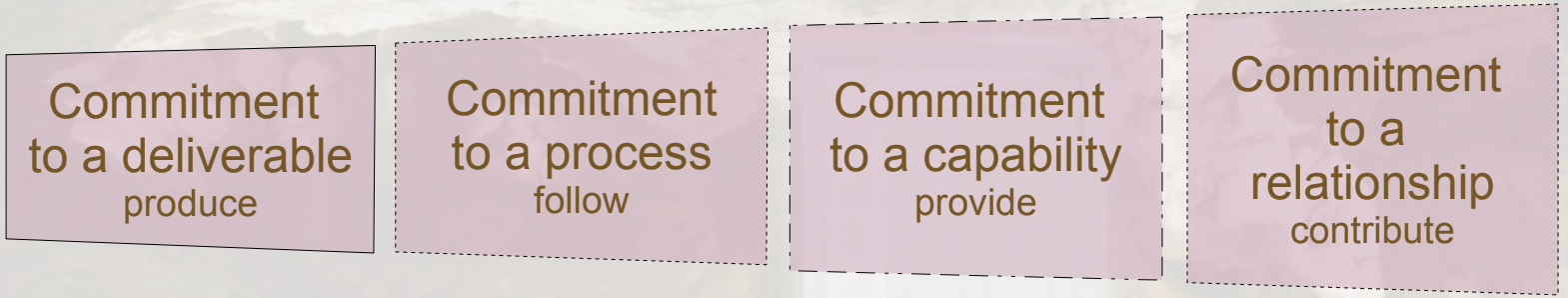
Value-elevating co-creation

- Providers and customer mutually experience, and then improve

Extended from Normann, Richard, and Rafael Ramírez. 1989. “A Theory of the Offering: Toward a Neo-Industrial Business Strategy.” In *Strategy Organisation Design, and Human Resource Management*, edited by Charles C. Snow, 111–28. J.A.I. Press; + Kijima, Kyoichi, and Yusuke Arai. 2016. “Value Co-Creation Process and Value Orchestration Platform.” In *Global Perspectives on Service Science*: Japan, edited by Kwan, Spohrer, and Sawatani, 137–54, Springer.

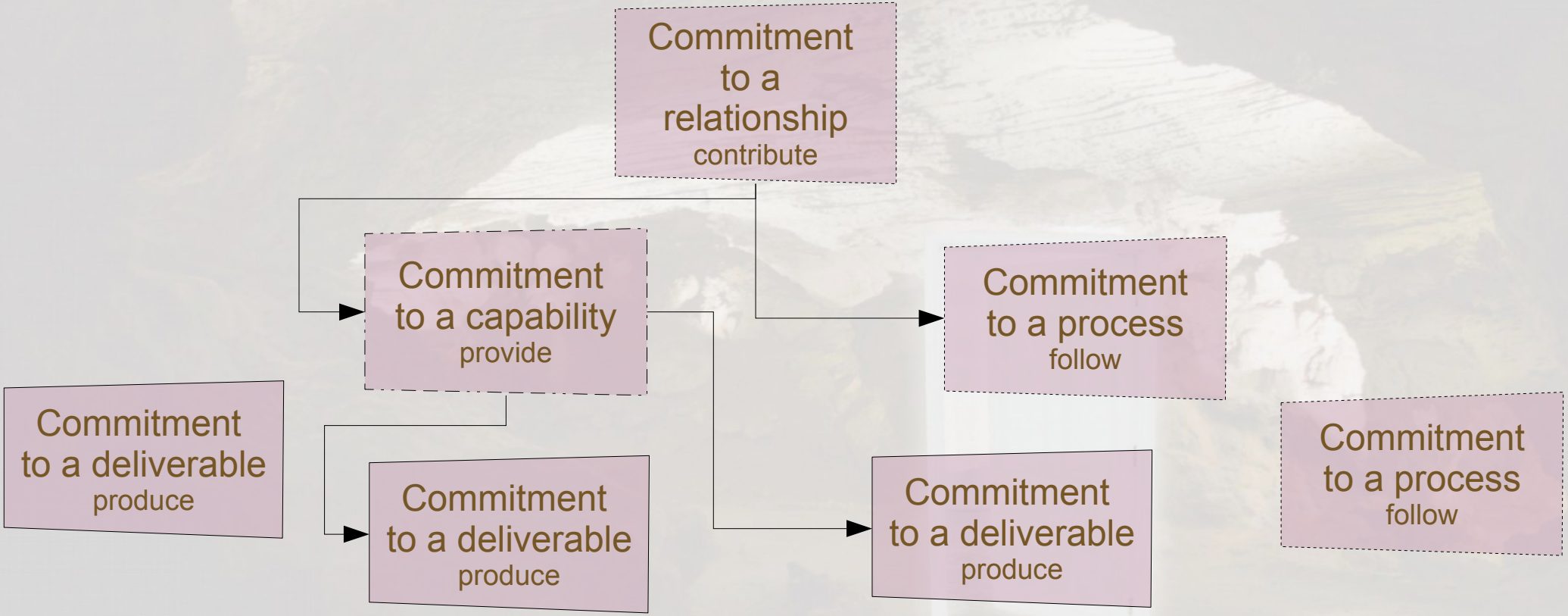
Images from Flickr: “Pimp My Ride” CC-BY 2011 Grey World; “”Oaks and Spokes Bicycle Repair Repair Station” CC-BY 2015 Kristy Dactyle; “Bettter Bike Share” CC-BY 2015 Better Bike Share Partnershp

Obligations can be formalized as commitments to deliverables, process and/or relationships (at least)



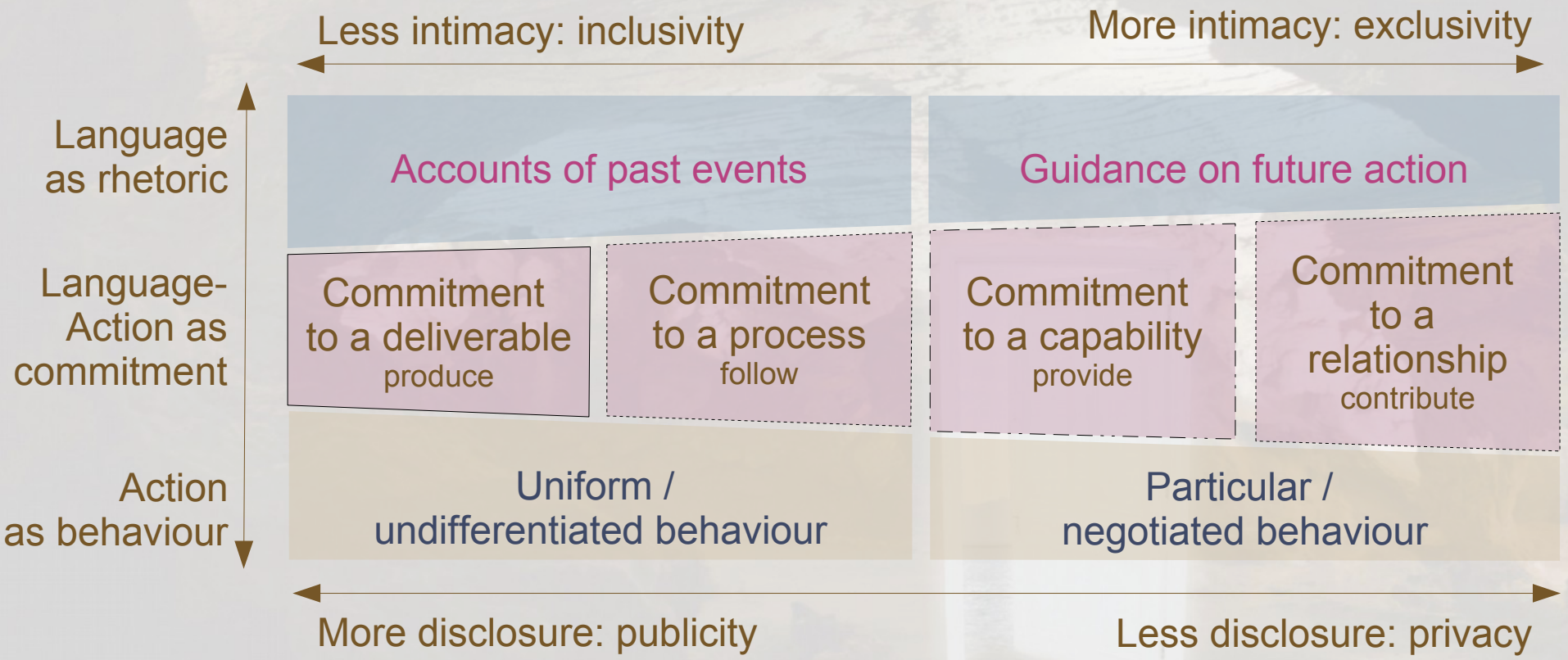
Ing, David. 2008. “Offerings as Commitments and Context: Service Systems from a Language Action Perspective.” In *Proceedings of the 12th International Conference of the UK System Society*. Oxford, UK.

Commitments can be explicitly linked upstream or downstream, and can be impacted by the unanticipated



Ing, David. 2008. "Offerings as Commitments and Context: Service Systems from a Language Action Perspective." In *Proceedings of the 12th International Conference of the UK System Society*. Oxford, UK.

Commitments occur in contexts of language decoupled from action, and action decoupled from language



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Supply-side sustainability manages systems from their context

We will achieve **sustainability** when it becomes a **transparent outcome** of managing the contexts of production and consumption rather than the consumption itself. If we shift our management emphases to **managing from the context for whole ecosystem functions, rather than for resources**, the cost of problem solving will diminish and the effectiveness of management greatly increase. When a manager **gets the context right, the ecosystem does the rest**. Because the material ecosystem supplies renewal resources and makes them renewable, we call our approach supply-side sustainability. [p. 14]

1.	**Manage for productive systems rather than for their outputs**	,,, understand the productive system as fully as possible and management for that. Sustainable outputs follow automatically, potentially at reduced management costs. […] In criminology it would consist of alleviating the factors thought to generate crime rather than trying to fortify every house and business and incarcerate every offender. [p. 15]
2.	**Manage systems by managing their contexts**	Any system is controlled one level up: by its context .... Management efforts are most effectively focused on on the system of interest ... but on the contexts that regulate such systems ….. [p. 16]
3.	**Identify what dysfunctional systems lack and supply only that**	To know precisely what ecosystems lack and provide only that takes research and monitoring on a variety of processes. It also takes managers who can ... understand a broad array of ecological phenomena, and who can comprehend both social and biophysical processes. [p. 19]
4.	**Deploy ecological processes to subsidize management efforts, rather than conversely**	In this strategy, the management objective is subsidized by processes that are free and available whether we use them or not: ... [pp. 385-386] ... on the ecosystem criterion, managers should concentrate on energy flows rather than structures. [pp. 386-387]
5.	**Understand the problem of diminishing returns to problem solving**	Human creativity in problem solving is often is constrained by the factors of complexity and costliness. The Roman Empire did not lack creativity or flexibility; it could not deploy them given its circumstances. [pp. 386-387]

Allen, Timothy F. H., Joseph A Tainter, and Thomas W. Hoekstra. 2003. *Supply-Side Sustainability*. New York: Columbia Univ Press.

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3. Innovation Learning

In the *21st century*, the *nature of innovation* is increasingly...

Open

Collaborative

Multidisciplinary

Global

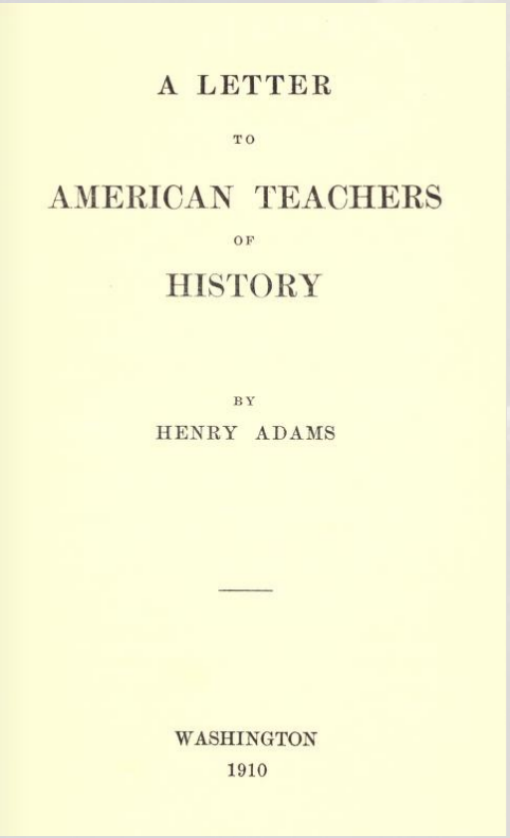
"Innovation as open, collaborative, multidisciplinary, global" | June 13, 2008 at http://coevolving.com/blogs/index.php/archive/innovation-as-open-collaborative-multidisciplinary-global/

An inferred shift from *Industrial Age innovation* educates

Industrial Age		*21st Century*
Private methods and development enabling autonomous control over designs	strategy	**Open** standards and interfaces leveraging expedient platforms for advancing design
Transactional production chains linked by inter-organizational contracting	relationship	**Collaborative** alliances coproducing accelerated learning
Analytical problem-solving	method	**Multidisciplinary** conversations
Colonial trade	economics	**Global** talent

"Innovation as open, collaborative, multidisciplinary, global" | June 13, 2008 at http://coevolving.com/blogs/index.php/archive/innovation-as-open-collaborative-multidisciplinary-global/

“Stable equilibrium is death”. Is *innovation learning* a living system?


A LETTER

TO

AMERICAN TEACHERS

OF

HISTORY

BY

HENRY ADAMS

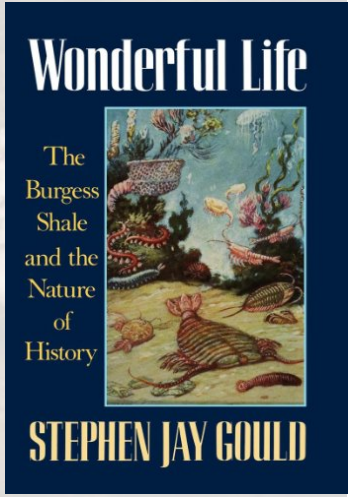
WASHINGTON

1910

… if one physical law exists more absolute than another, it is the law that **stable equilibrium is death**.

A society in stable equilibrium is — by definition, — one that has history, and wants not historians. [Adams, p. 186]

… Gould has shown that evolution has been by catastrophes, like the one that caused the demise of the dinosaurs and more serious ones that extinguished up to percent of all species nearly six hundred million.
Gould has concluded that such catastrophes have been more instrumental in shaping the course of evolution than competition and natural selection.
If so, then no necessary direction can be imputed to evolution, and **the current state of nature may not be inevitable and predictable**. [Burich p. 645]

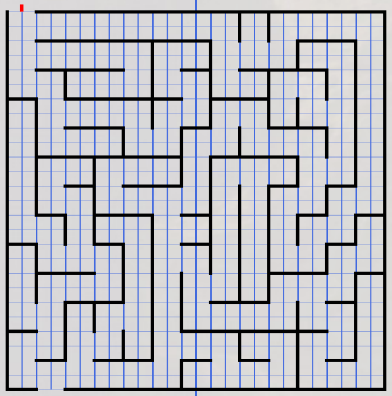


Adams, Henry. 1910. A Letter to American Teachers of History. Washington [Press of J.H. Furst]. http://archive.org/details/alettertoamerica00adamuoft.

Burich, Keith R. 1992. “‘Stable Equilibrium Is Death’: Henry Adams, Sir Charles Lyell, and the Paradox of Progress.” The New England Quarterly 65 (4): 631–47. doi:10.2307/365825.

“Stable equilibrium is death” at https://stream.syscoi.com/2017/09/24/stable-equilibrium-is-death/

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.

Tim Ingold, 2013. "The Maze and the Labyrinth: Walking and The Education of Attention." In *Walk On: From Richard Long to Janet Cardiff -- 40 Years of Art Walking*, edited by Cynthia Morrison-Bell and Mike Collier, pp. 6–11, https://issuu.com/stereographic/docs/walkon_for_issuu.

Normative theory on *Innovation Learning* may guide emerging cases

Innovation Learning with the rise of:

Polycentric Governance

- Deglobalization, Brexit, Trump presidency
- International innovation as:
  - i) complete concentration; or
  - ii) core-periphery concentration; or
  - iii) sequential dispersal; or
  - iv) modularized dispersal; or
  - v) inclusive dispersal.

Innovation Learning with the rise of:

The Internet of Things (IoT)

- Physical world interweaved with actuators, sensors + computational elements through network connectivity
- Smart cities
- Smart homes
- Smart grid
- Smart buildings
- Smart transportation
- Smart health
- Smart industry

Innovation Learning with the rise of:

Cognitive Computing

(Intelligence Augmentation)

- An evolution from
  - mechanical tabulating era (1900s-1940s); to
  - digital programming era (1950s to present); to
  - cognitive era (2011, IBM Watson winning Jeopardy).
- Man-machine symbiosis in cooperative interaction
- Open AI
- Partnership on AI

Three *normative theory building* streams are alongside one *paradigm*

Paradigm:

Co-responsive movement

- Ecological anthropology: getting a grip on the larger world
- Material culture studies: artifacts with physicality + history with associated human beings

Theory building:

Innovation learning for

- Enskilling attentionality
- Episteme (know why)

Theory building:

Innovation learning by

- Weaving flows in form-giving
- Techne (know how)

Theory building:

Innovation learning alongside

- Agencing strands
- Phronesis (know whom, when, where)

Innovation learning for: *enskilling attentionality* as 3 types

Paradigm:

Co-responsive movement

Theory building:

Innovation learning **for**

- Enskilling attentionality
- Episteme (know why)

Type: Proto-learning
- Selecting an alternative in context

Type: Deutero-learning
- Changing the set or sequence of alternatives in contextual change

Type: Trito-learning
- Changing systems of alternatives in meta-contextual change

Innovation learning by: *weaving flows in form-giving* as 3 types

Paradigm:

Co-responsive movement

Theory building:

Innovation learning **by**

- Weaving flows in form-giving
- Techne
  (know how)

Type: **Learning-by-doing**

- Accumulating experience, in both organizational + personal senses

Type: **Learning-by-making**

- Constructing with sociomaterial creativity, in critical making

Type: **Learning-by-trying**

- Co-configuring architecturally + dialogically, social interaction + technology

Innovation learning alongside: agencing strands as 3 types

Paradigm:

Co-responsive movement

Theory building:

Innovation learning **alongside**

- Agencing strands
- Phronesis (know whom, when, where)

Type: Polyrhythmia entangling eurhythmia

- Experience in living beings

Type: Regenerating entangling preserving

- Continuity in living nature vs. form

Type: Less-leading-to-more entangling more-leading-to-more

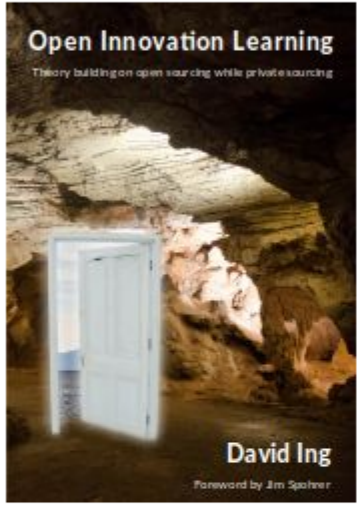
- Increasing complicatedness or complexity

Is your (smart) system generative?

Systematic	*Systemic*
Somatic (adaptive, cellular) change	Genotypic (generational) change
Non-living, effect-producing (allopoietic)	Living, systems-generating (autopoietic)
Reactive	Co-responsive

Get the book

Open Innovation Learning: Theory-building on open sourcing while private sourcing, CC-BY-SA 2017, 2018 David Ing; preface by Jim Spohrer.



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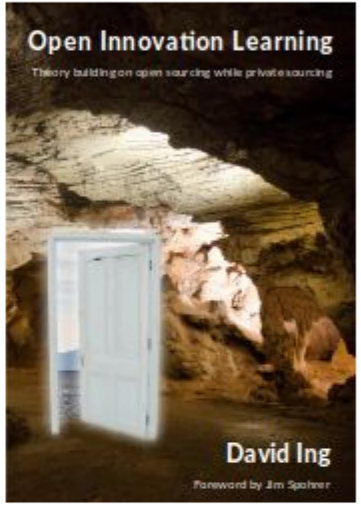

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