Systems Coevolving:
Sciences, Service, Smarter, Cognitive

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February 10, 2016

Systems Research and Behavioral Science
Syst. Res. **30**, 527–547 (2013)
Published online 10 October 2013 in Wiley Online Library
(wileyonlinelibrary.com) **DOI**: 10.1002/sres.2229

■ *Research Paper*

Rethinking Systems Thinking: Learning and Coevolving with the World

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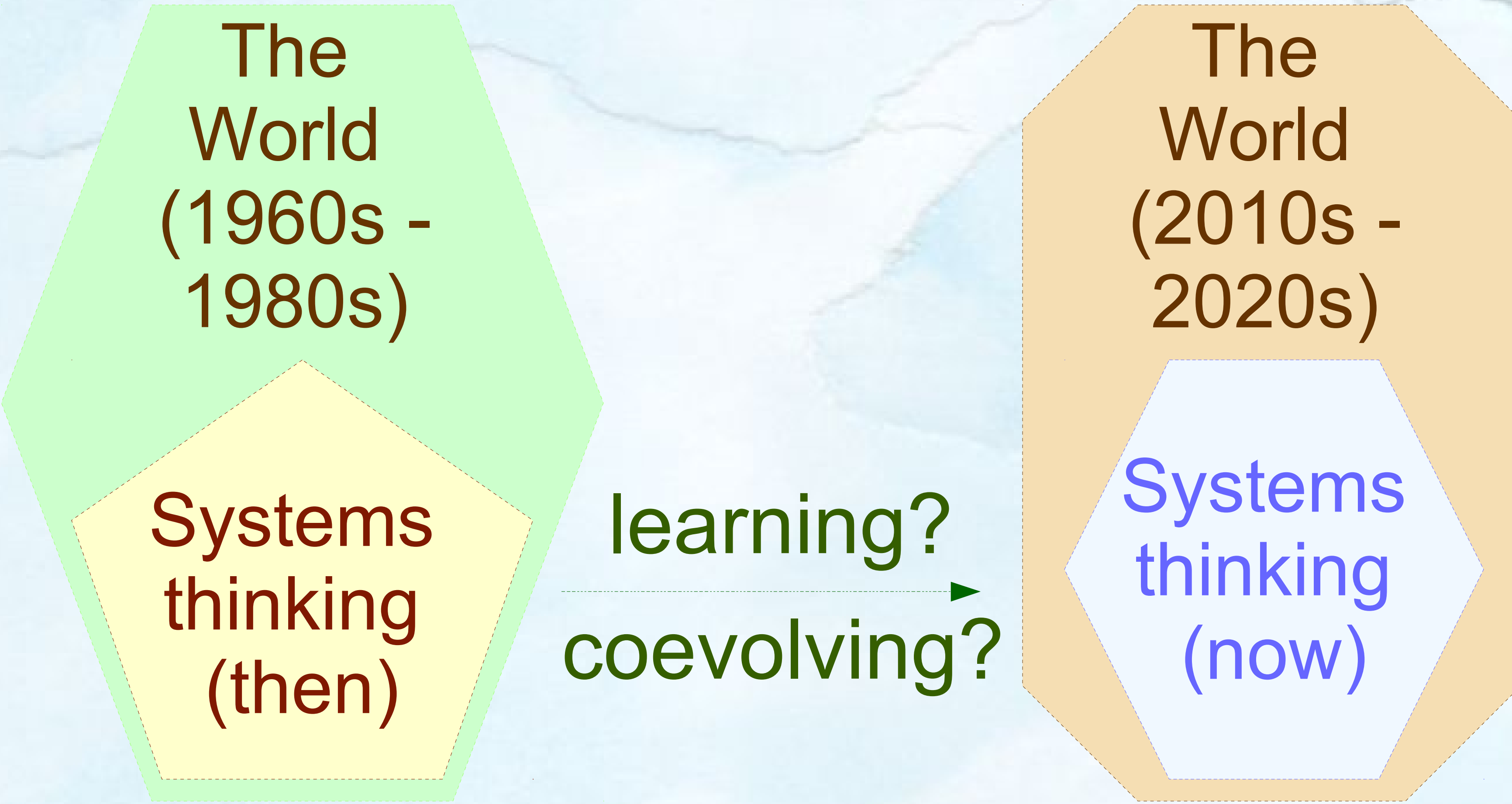
Much of systems thinking, as commonly espoused today, was developed by a generation in the context of the 1950s–1980s. In the 2010s, has systems thinking changed with the world in which it is to be applied? Is systems thinking *learning* and *coevolving* with the world? Some contemporary systems thinkers continue to push the frontiers of theory, methods and practice. Others situationally increment the traditions of their preferred gurus, where approaches proven successful in prior experiences are replicated for new circumstances. Founded on interactions with a variety of systems communities over the past 15 years, three ways to rethink systems thinking are proposed:

1. 'parts and wholes' snapshots → 'learning and coevolving' over time
2. social and ecological → emerged environments of the service economy and the Anthropocene
3. episteme and techne → phronesis for the living and nonliving

These proposed ways are neither exhaustive nor sufficient. The degree to which systems thinking should be rethought may itself be controversial. If, however, systems thinking is to be authentic, the changed world of the 21st century should lead systems thinkers to

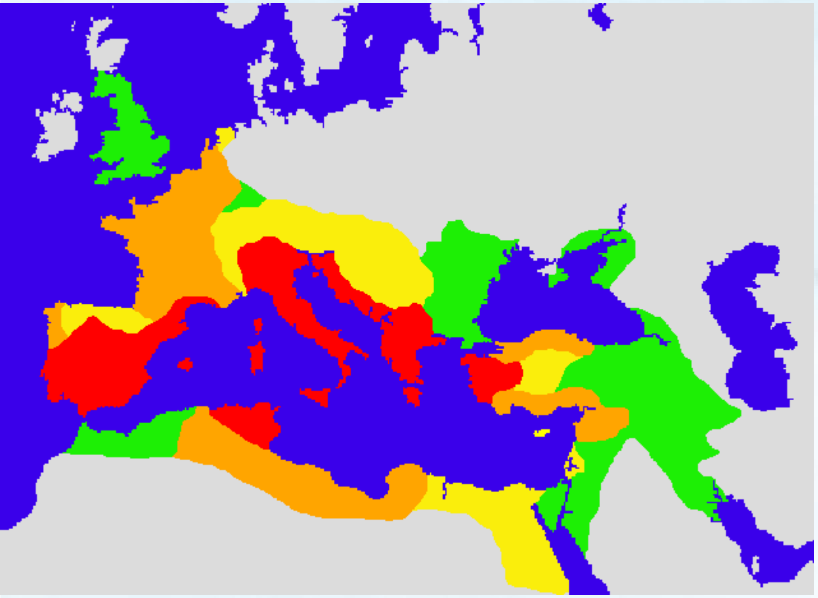
Is systems thinking *learning* and *coevolving* with the *world*?



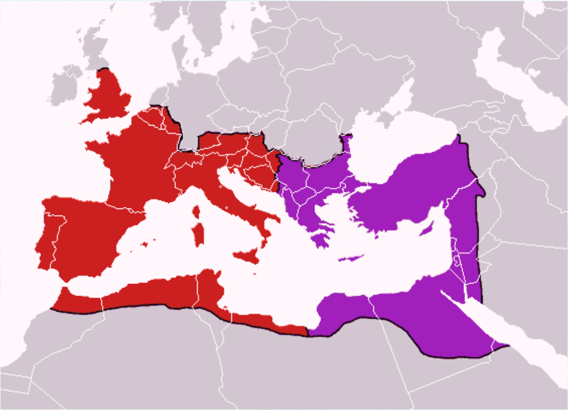
Agenda

1. Systems Sciences
2. SSMED
   (Service Science, Management, Engineering and Design)
3. Service Systems Science
4. Smarter Planet, Smarter Cities
5. Cognitive Era
6. Service Systems Thinking

Expansion and collapse –
Roman Empire (167 BC - 486 AD) c.f. Byzantine Empire (491 AD to 1025 AD)



The extent of the Roman Empire in around 133 BC (red), 44 BC (orange), 14 AD (yellow), and 117 AD (green).



After the death of Theodosius I, in 395 AD. Western Roman Empire (dark red); Eastern Roman Empire (magenta)

The Byzantine Empire and its provinces at the death of Basil II, 1025

Source: Atlas of Ancient Rome at https://commons.wikimedia.org/wiki/Atlas_of_Ancient_Rome; Atlas of the Byzantine Empire at https://commons.wikimedia.org/wiki/Atlas_of_the_Byzantine_Empire

Complexity in social systems refers to *differentiation and organization* or to *increasing organization.*

[Contrast] between a social unit that was simple, in an anthropological sense, and one that is much more complex.

[… The] Dominguez Ruin, a small pueblo ruin of the twelfth century A.D. in what is now southwestern Colorado. The structure is small, simple, and undifferentiated, reflecting the group that produced it.

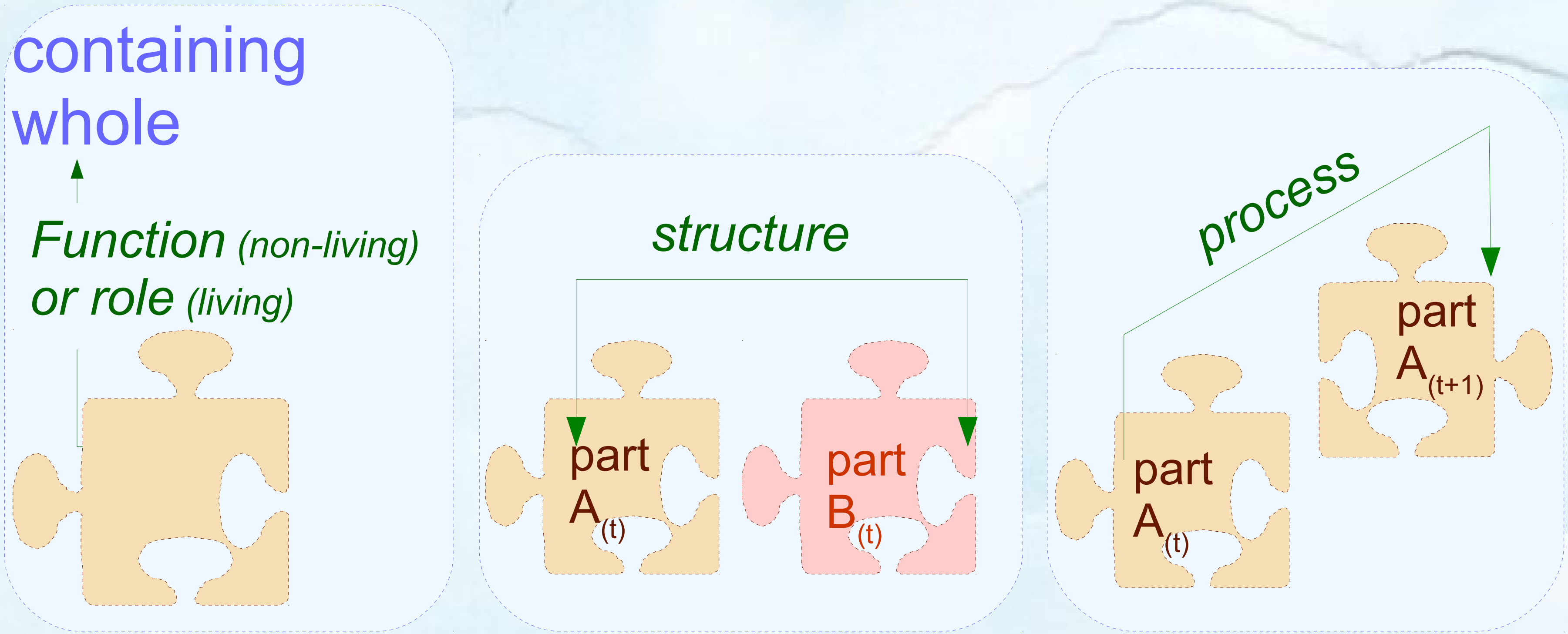
[… The] Anasazi Heritage Center, where the remains of the prehistoric people are stored and studied. It is many times the the size of the small pueblo, and requires a permanent staff and a fleet of vehicles. The staff is hierarchically organized and differentiated by specialization. The center's existence is authorized by the federal government, which provides the funds it needs. The energy needed to heat and cool the building may well exceed what the entire prehistoric community consumed when the Dominguez Ruin was occupied.

The two structures reflect societies that are vastly differentiated not only in scale, but also in complexity. [p. 62]

Images: James Q. Jacob, Southwest Anthropology and Archaeology Pages (2013), http://www.jqjacobs.net/southwest/anasazi.html .

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

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



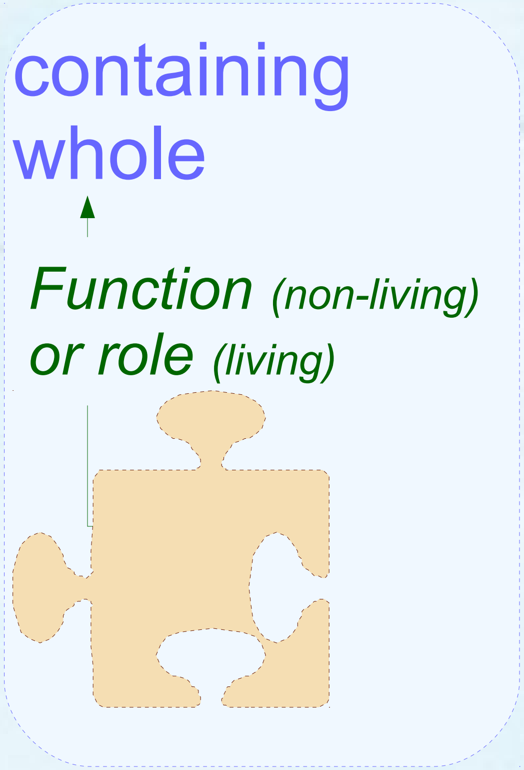
Function
"contribution of the part to the whole"

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



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.

Complex systems → Network thinking

There is no generally accepted formal definition of “complex system”. Informally, a complex system is a large network of relatively simple components with no central control, in which emergent complex behavior is exhibited. Of course, the terms in this definition are not rigorously defined. “Relatively simple components” means that the individual components, or at least their functional roles in the system’s collective behavior, are simple with respect to that collective behavior. For example, a single neuron or a single ant are complicated entities in their own right. However, the functional role of these single entities in the context of an entire brain or an entire colony is relatively simple as compared with the behavior of the entire system.

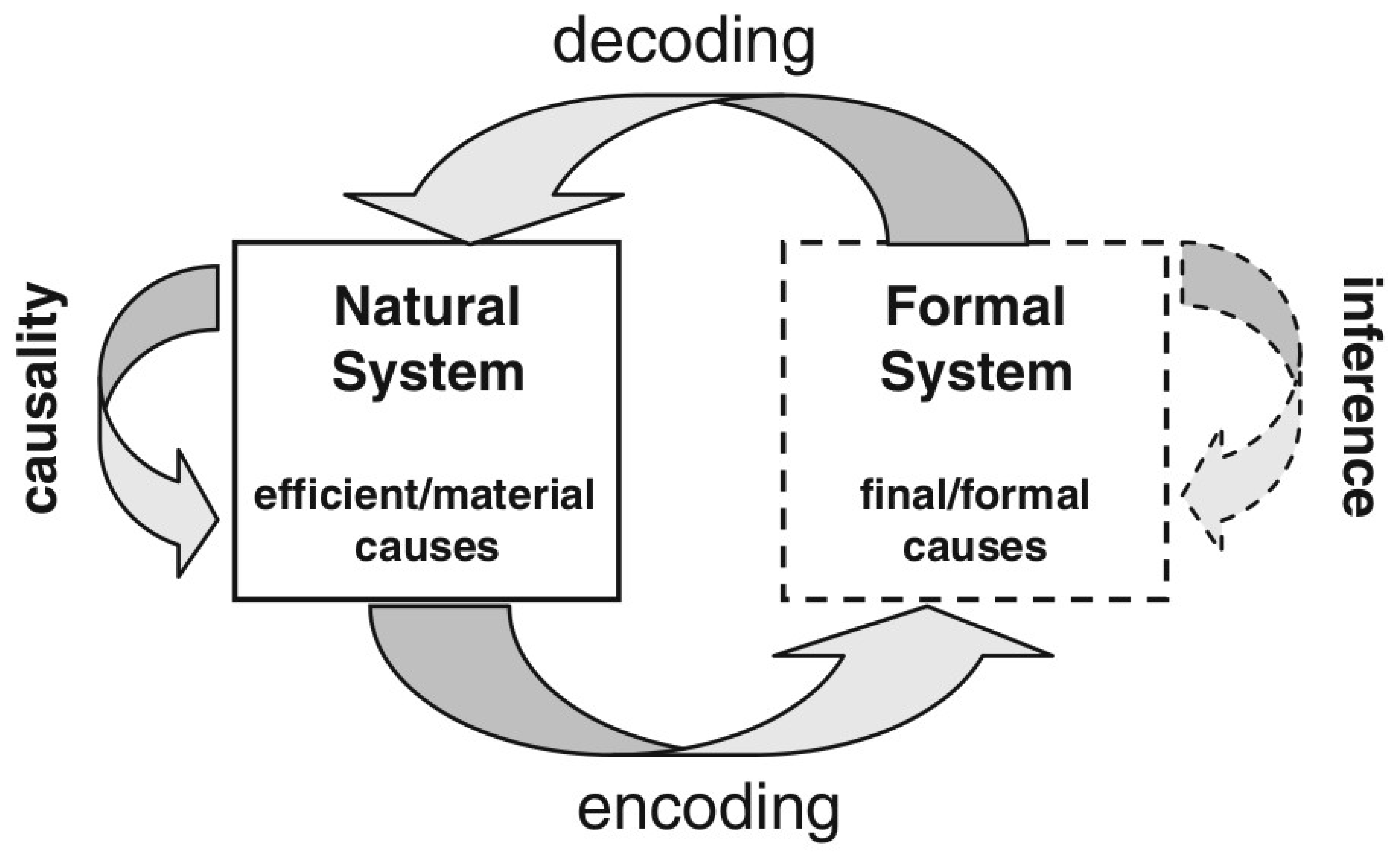
“Emergent complex behavior” is tougher to define. Roughly, the notion of emergence refers to the fact that the system’s global behavior is not only complex but arises from the collective actions of the simple components, and that the mapping from individual actions to collective behavior is non-trivial. The notion of nonlinearity is important here: the whole is more than the sum of the parts. The complexity of the system’s global behavior is typically characterized in terms of the patterns it forms, the information processing that it accomplishes, and the degree to which this pattern formation and information processing are adaptive for the system—that is, increase its success in some evolutionary or competitive context. In characterizing behavior, complex-systems scientists use tools from a variety of disciplines, including nonlinear dynamics, information theory, computation theory, behavioral psychology, and evolutionary biology, among others.

The field of complex systems seeks to explain and uncover common laws for the emergent, self-organizing behavior seen in complex systems across disciplines. Many scientists also believe that the discovery of such general principles will be essential for creating artificial life and artificial intelligence.

Complex systems, as their name implies, are typically hard to understand. Traditionally the more mathematically oriented sciences such as physics, chemistry, and mathematical biology have concentrated on simpler model systems that are more tractable via mathematics. The rise of interest in understanding general properties of complex systems has paralleled the rise of the computer, because the computer has made it possible for the first time in history to make more accurate models of complex systems in nature.

Source: Melanie Mitchell. 2006. “Complex Systems: Network Thinking.” *Artificial Intelligence* 170 (18): 1194–1212. doi:10.1016/j.artint.2006.10.002. Also as Working Paper. Santa Fe Institute. http://www.santafe.edu/research/working-papers/abstract/986548948d2c660564b407678933664d/ .

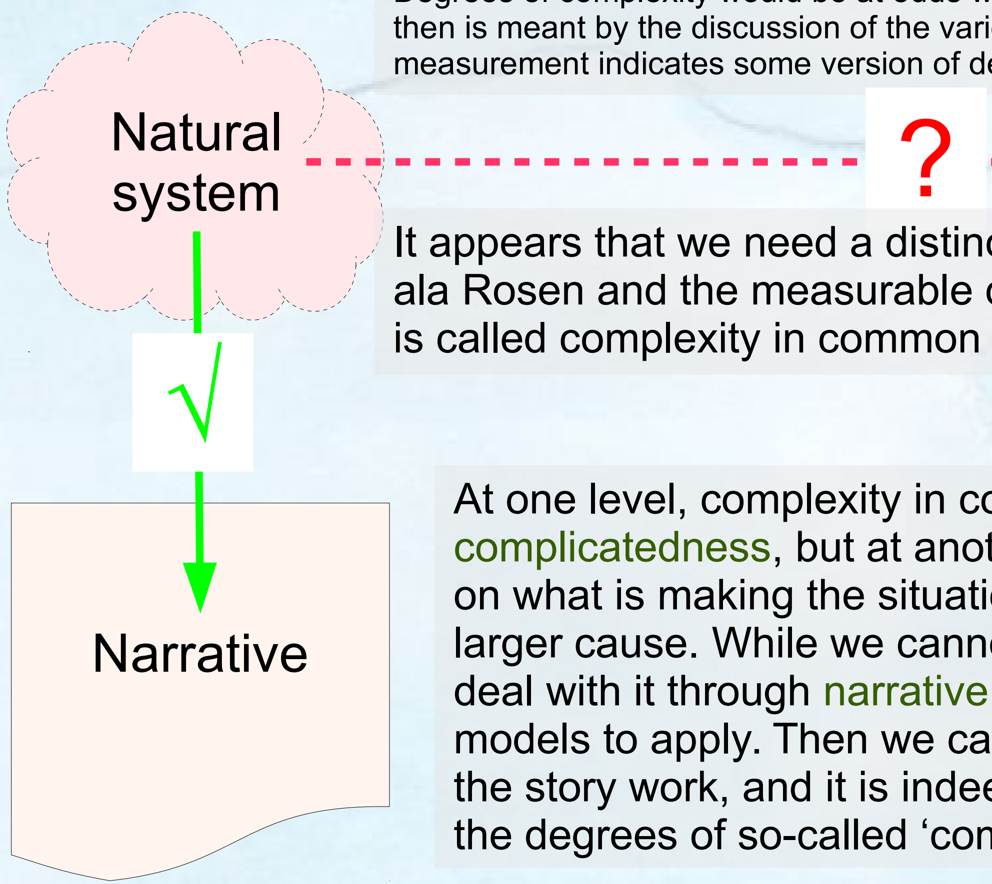
Rosen used modeling relations to describe science ideally as a commuting relation between natural systems and formal (mathematical) systems

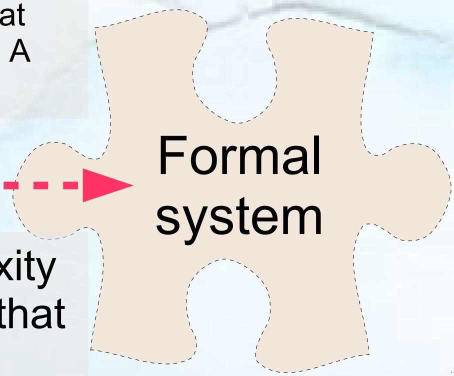


Source: Kineman, John J. 2011. "Relational Science: A Synthesis." *Axiomathes* 21 (3): 393–437. doi:10.1007/s10516-011-9154-z.

Complexity in a natural system --> formal system? Narratives?

Rosen (2000) insists that complexity is not a matter of degree. He says that complexity applies to things that cannot be modelled. This makes complexity a discrete category, because you can either model something or you cannot. Degrees of complexity would be at odds with Rosen's statement, so what then is meant by the discussion of the various measures of complexity? A measurement indicates some version of degree.





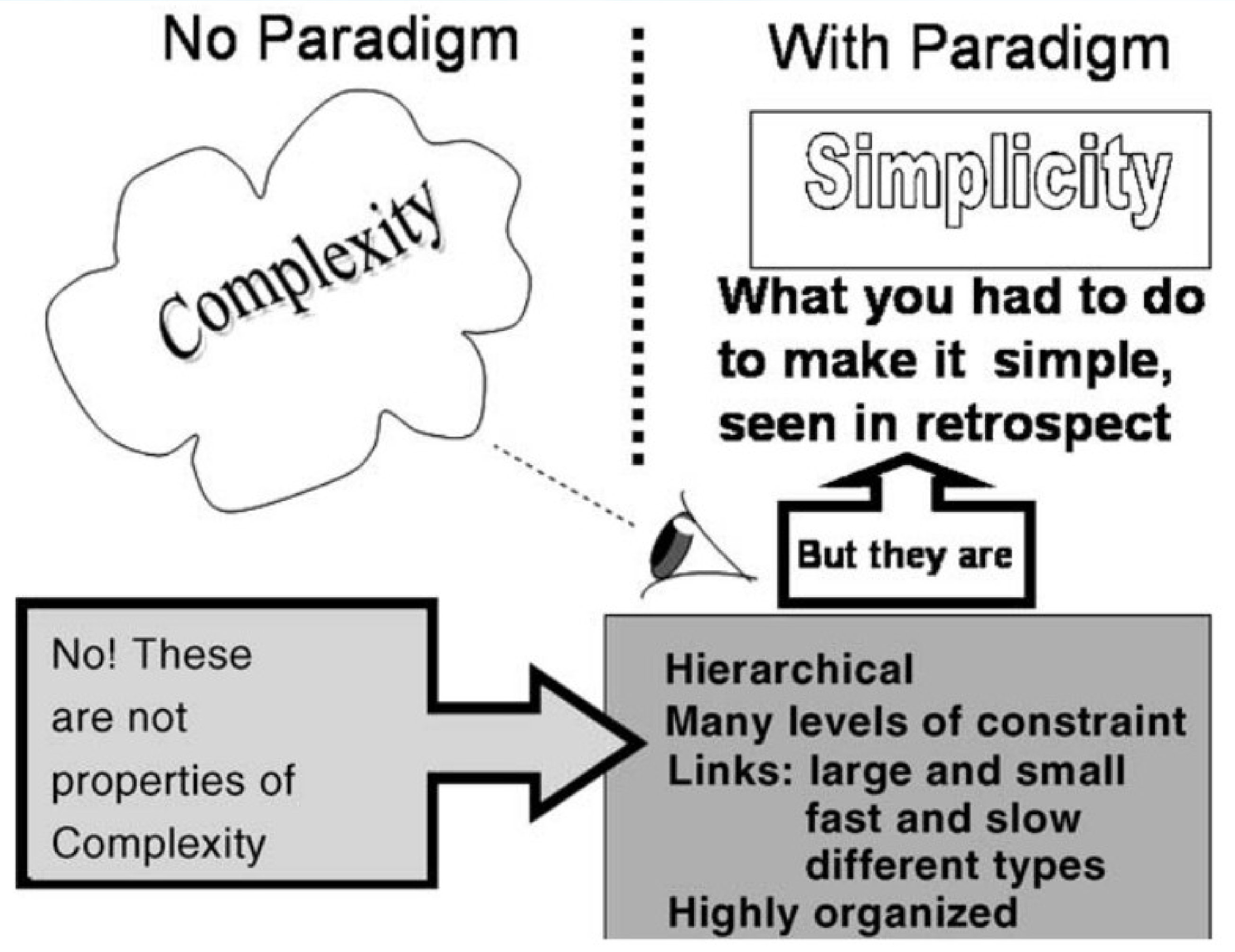
It appears that we need a distinction between complexity ala Rosen and the measurable degree of elaboration that is called complexity in common parlance.

At one level, complexity in common usage means only complicatedness, but at another level that use of complexity has an eye on what is making the situation so complicated. Rosen addresses that larger cause. While we cannot model the complexity of Rosen, we can deal with it through narrative, which simplifies the situation enough for models to apply. Then we can look to see what had to be done to make the story work, and it is indeed these translations into narrative that give the degrees of so-called 'complexity'.

Source: Allen, Timothy F. H., and Mario Giampietro. 2006. "Narratives and Transdisciplines for a Post-Industrial World." *Systems Research and Behavioral Science* 23 (5): 595–615. doi:10.1002/sres.792.

Complexity is a matter of not having a paradigm.

The properties assigned to complex systems by lay and expert opinion alike are no such thing. They are what you do to make a system simple.



Source: Zellmer, Amanda J., Timothy F. H. Allen, and K. Kesseboehmer. 2006. “The Nature of Ecological Complexity: A Protocol for Building the Narrative.” *Ecological Complexity* 3 (3): 171–82. doi:10.1016/j.ecocom.2006.06.002.

1998 – Timothy F.H. Allen: Complexity, complicatedness

Systems Research and Behavioral Science
Syst. Res. 16, 403–427 (1999)

■ *Research Paper*

Supply-Side Sustainability

T. F. H. Allen[1],* Joseph A. Tainter[2] and T. W. Hoekstra[3]

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[2]*USDA Forest Service, Rocky Mountain Research Station, Albuquerque, NM, USA*
[3]*USDA Forest Service Monitoring Institute, Fort Collins, CO, USA*

Historically, societies have been abandoned when management invoked complicated infrastructure that diminished returns on effort. Some societies survived by redefining their relationship to the resource base through emergence of a new, more elaborate level of organization. Organization may elaborate when resources are expanded or used more efficiently. The new situation favorably resets the cost/benefit ratio of problem solving. With six billion people, our critical problem is the capture of natural resources while maintaining ecosystem function to keep them renewable. Presently resource management is too complicated at too low a level, and suffers diminishing returns. Supply-side sustainability recommends management from the context for the function of the whole ecosystem, not the resource. Then ecosystems integrate materials and energy sustainability, while generating resources that humans can take. To achieve a global level of organization of resource management we see a new relationship between the feedback of commerce, greened by the social and environmental resource sciences in the academy, with governmental catalysis. Published in 1999 by John Wiley & Sons, Ltd.

Keywords average product; benefit; collapse; commerce; complexity; complicatedness; cost; economics; ecosystem; elaboration; emergence; energy; global; gradient; hierarchy; history; infrastructure; management; marginal product; organization; problem solving; positive feedback; revolution; renewable resources; society; structure; sustainability; thermodynamics

The crucial problem facing the developed world with regard to sustainability is extraction of renewable resources, while keeping them renewable. Failure to solve this problem will have deleterious effects for almost everyone on the planet. In *The Collapse of Complex Societies*, Tainter (1988) identifies the root of the collapses of many complex societies as being diminishing returns on efforts to solve problems, including problems of resource supply. In many historical examples there is an elaboration of infrastructure within societies as problems become more challenging. The cost of constant innovation creates a burden that is generally placed on individuals across that society as a set of greater

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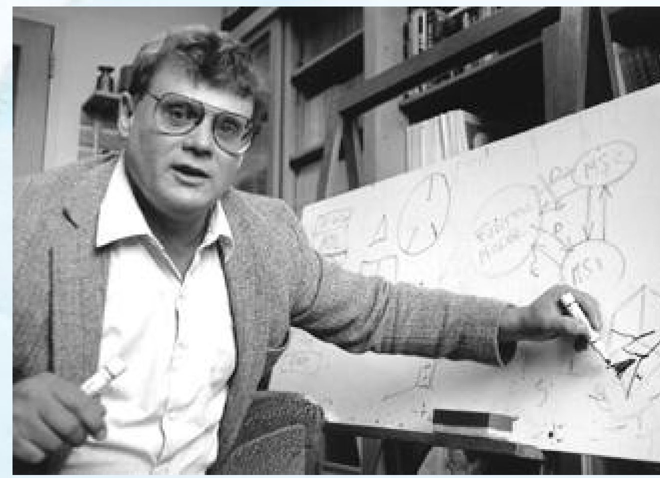

Complexity, complicatedness

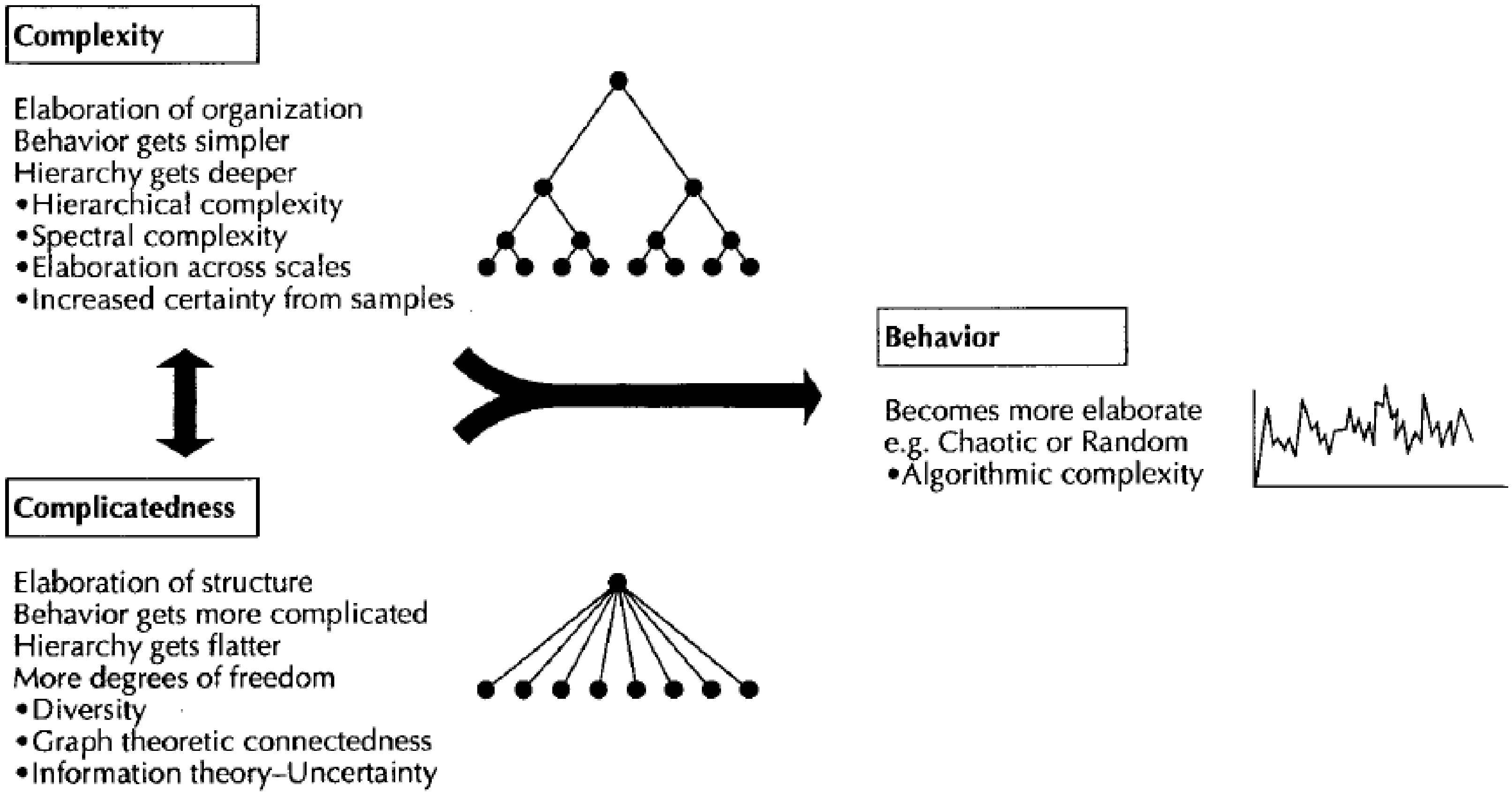

Figure 5. The measures of structurally, organizationally or behavioral elaboration are next to bullets beneath the system in question, while the characteristics of the system are listed above the bulleted measures. On the lower left of the figure is diagrammed a simple system that is only complicated. Complicatedness arises from elaborations of system structure, shown here as a wider span. At the upper left is diagrammed a complex system with elaboration of constraints and organization shown by new levels in a hierarchy of greater depth. At the middle right of the figure, the opposing effects of complexity and complicatedness are integrated in behavioral complexity

Ecological Modelling 293 (2014) 31–41

Contents lists available at ScienceDirect

Ecological Modelling

journal homepage: www.elsevier.com/locate/ecolmodel

Holons, creaons, genons, environs, in hierarchy theory: Where we have gone

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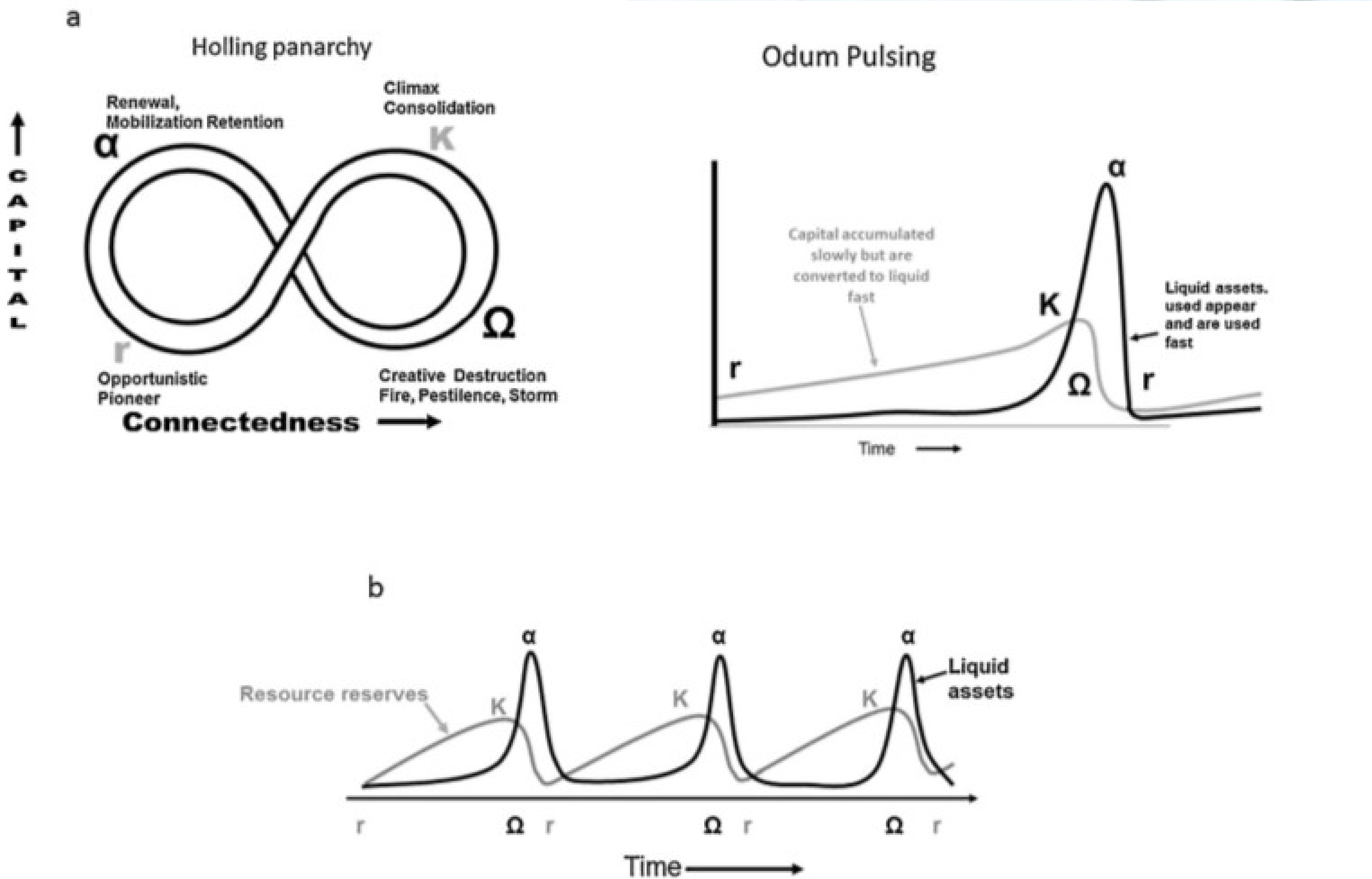
ARTICLE INF

Article history:
Received 28 October 2013
Received in revised form 24 Ju
Accepted 25 June 2014
Available online 16 July 2014

Keywords:
Complexity
Hierarchy theory
Holon
Network ecology
Narrative
Systems analysis



This paper compare
work theory, as devices
Our purpose is to instr
intend to show practi
archy and network appr

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http://dx.doi.org/10.1016/j.ec
0304-3800/© 2014 Elsevier B.

Fig. 3. (a) A comparison between on cycle of Odum, and a single pass around Holling's lazy 8. (b) Odum's pulsing against the labels for Holling panarchy stages over several cycles. The Odum cycle of (a), but showing repeated cycles.

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Almaden Services Research

IBM Research

Service Science, Management & Engineering

SSME

Conference Summary

Overview

From October 5 through 7, 2006, two-hundred fifty four people, representing 21 countries and many areas of government, industry, and academia, gathered at the IBM Palisades Conference Center in New York to discuss Service Science, Management, and Engineering (SSME). Sponsored by IBM Research, IBM University Relations, IBM Government Programs, the conference aimed to demonstrate results in the formation of multi-disciplinary SSME, (including ways SSME has been introduced into curricula, and services research that is underway or is planned) and also to outline a roadmap for establishing SSME as its own discipline (including how practitioners can join with faculty and administrators to focus efforts on cross-functional, service-oriented courses and research, and recommended actions for academia and governments).

A welcome reception was held the evening of October 5 with an opening talk by Gina Poole, IBM Vice President, Innovation and IBM University Relations . On the morning of October 6, the meeting was kicked off by Robert Morris , IBM Vice President, Services Research, who set the context and expectations for the two days. The keynote address by Nick Donofrio , IBM Executive Vice President, Innovation and Technology, focused on the need for a national post-secondary educational strategy and activities to create it. There were talks from multiple university representatives and a government panel session that addressed new funding initiatives. Carl Schramm , President and CEO, Kauffman Foundation, gave an address on the changing economy and new roles of individuals, government, industry, and education. Val Rahmani, IBM General Manager, Infrastructure Management Services, shared her views on the practical application of service science. Irving Wladawsky-Berger , IBM Vice President, Technical Strategy and Innovation, provided a wrap-up for the day, focusing on the relation between service systems and complex engineering systems . The day ended with a poster reception that further highlighted service education and research at more than 30 additional universities world-wide.

The second day's opening talk was given by Debra Stewart , President, Council of Graduate Schools , on the mobilization of training and research around compelling areas that will drive the economy of the future. The day included additional talks from university representatives. A business partner panel that discussed the need for experiential learning, acquisition of skill, and the need for implementation and application of services thinking in the marketplace completed the sessions. The conference closed with a summary given by Stuart Feldman , IBM Vice President, Computer Science Research, who articulated the need for pi-shaped people -- not just t-shaped people -- that is, those with depth in multiple areas along with breadth in even more areas.

In addition to presenters, the audience included leadership outside academia and IBM, including representation from foundation agencies, government agencies, agencies for advanced studies and industries (see the list of invited institutions).

Insights and Outcomes

There seemed to be much excitement at the meeting, perhaps generated because for the first time, the study and understanding of service had come together as unique, distinguishable topic. Of course, not everyone agreed on how to approach the topic, but a common language is starting to develop, drawing government, industry, and education together and generating new questions, intellectual excitement, and ultimately economic value. A community is coming together with at least five clusters of intellectual impetus.

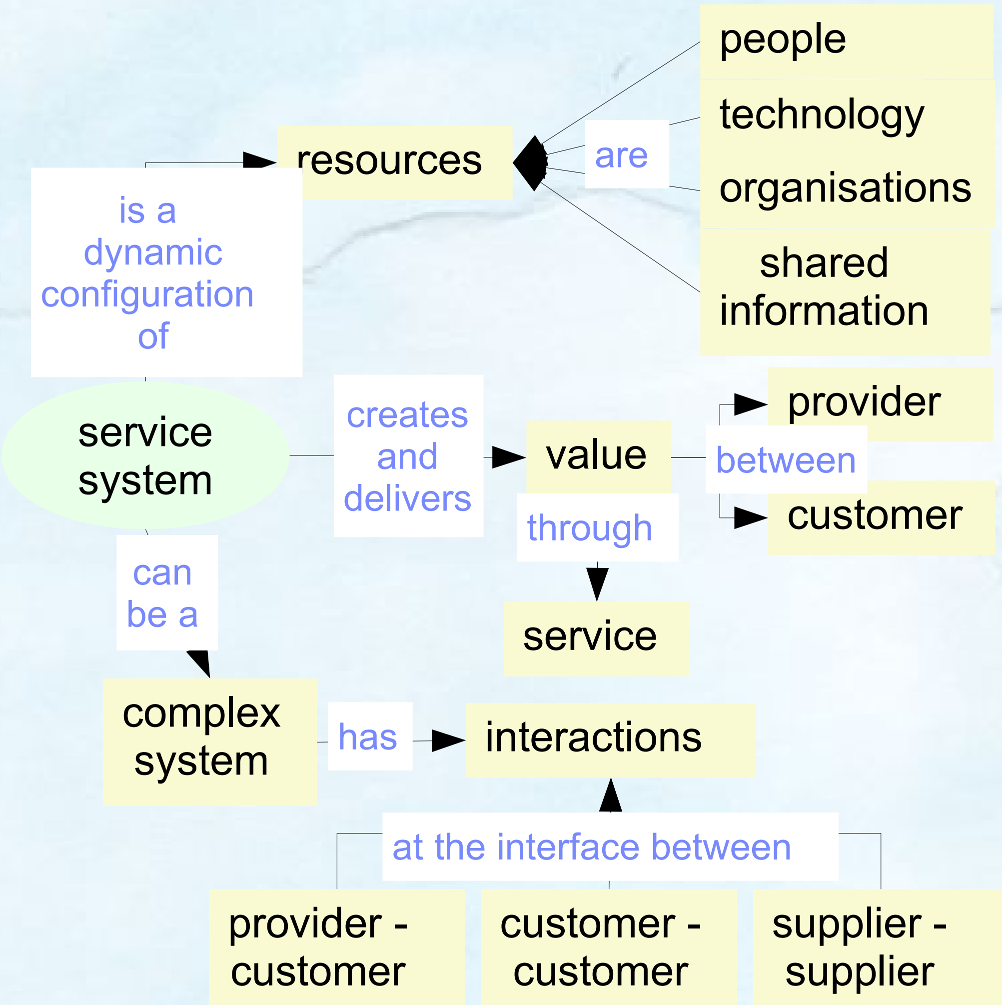
- operations research / mathematics / optimization,
- industrial engineering / systems engineering,
- computer science / information technology / information management,
- process formalization / physics / complexity, and
- business / organizational sciences / social sciences.

As Stu Feldman stated, "anything really exciting will happen with a crossing at the clusters." Many university faculty demonstrated substantive results in the formation of multidisciplinary Service Science, Management and Engineering initiatives. They presented ways SSME has been introduced into curricula to date and learned about services research underway or planned at other institutions. Several outlined suggested steps for establishing SSME as a legitimate discipline within the academic community. A few identified how practitioners can join with faculty and administrators to focus efforts on cross-functional, service-oriented courses and research. Others identified recommended actions for academia and governments.

	Products: 17% of *Delivery Form*	**Services**: 83% of *Delivery Form*
Material: 37% of *End Product*	**11%** of GNP (in 1997, ↓ from 19% of 1968 GNP)	**27%** of GNP (in 1997, ↓ from 35% of 1968 GNP)
Information: 63% of *End Product*	**7%** of GNP (in 1997, ↓ from 11% of 1968 GNP)	**56%** of GNP (in 1997, ↑ from 36% of 1968 GNP)

Uday M. Apte, Uday S. Karmarkar and Hiranya K Nath, "Information Services in the US Economy: Value, Jobs and Management", *Business and Information Technologies (BIT) Project*, Anderson School of Management at UCLA, June 2007

Service systems (Cambridge IfM and IBM, 2008)



A service system can be defined as a dynamic configuration of resources (people, technology, organisations and shared information) that creates and delivers value between the provider and the customer through service.

In many cases, a service system is a complex system in that configurations of resources interact in a non-linear way. Primary interactions take place at the interface between the provider and the customer. However, with the advent of ICT, customer-to-customer and supplier-to-supplier interactions have also become prevalent. These complex interactions create a system whose behaviour is difficult to explain and predict. (IfM and IBM, 2008, p. 6)

Source: IfM, and IBM. 2008. *Succeeding through Service Innovation: A Service Perspective for Education, Research, Business and Government.* Cambridge, UK: University of Cambridge Institute for Manufacturing. http://www.ifm.eng.cam.ac.uk/ssme/ .

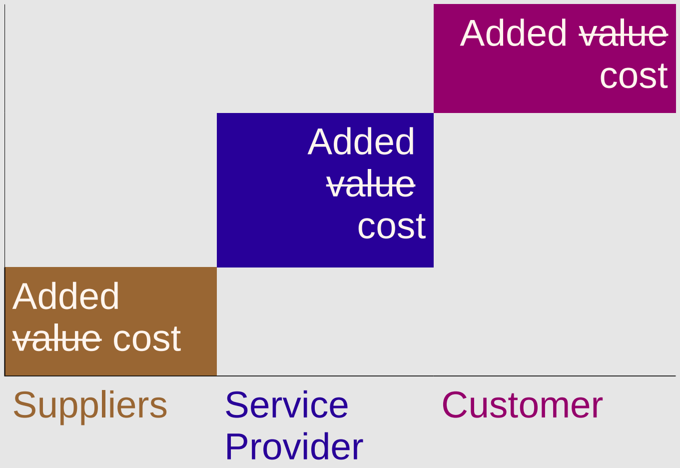
Service systems in our society can be ranked from concrete to abstract, as subjects for schoolchildren

Systems that move, store, harvest, process	• Transportation	K
	• Water and waste management	1
	• Food and global supply chain	2
	• Energy and energy grid	3
	• Information and communications (ICT) infrastructure	4
Systems that enable healthy, wealthy and wise people	• Building and construction	5
	• Banking and finance	6
	• Retail and hospitality	7
	• Healthcare	8
	• Education (including universities)	9
Systems that govern	• Government (cities)	10
	• Government (regions / states)	11
	• Government (nations)	12

Source: Spohrer, James C., and Paul P. Maglio. 2010. “Toward a Science of Service Systems: Value and Symbols.” In Service Science: Research and Innovations in the Service Economy, edited by Paul P. Maglio, Cheryl A. Kieliszewski, and James C. Spohrer, 157–94. 10.1007/978-1-4419-1628-0_9

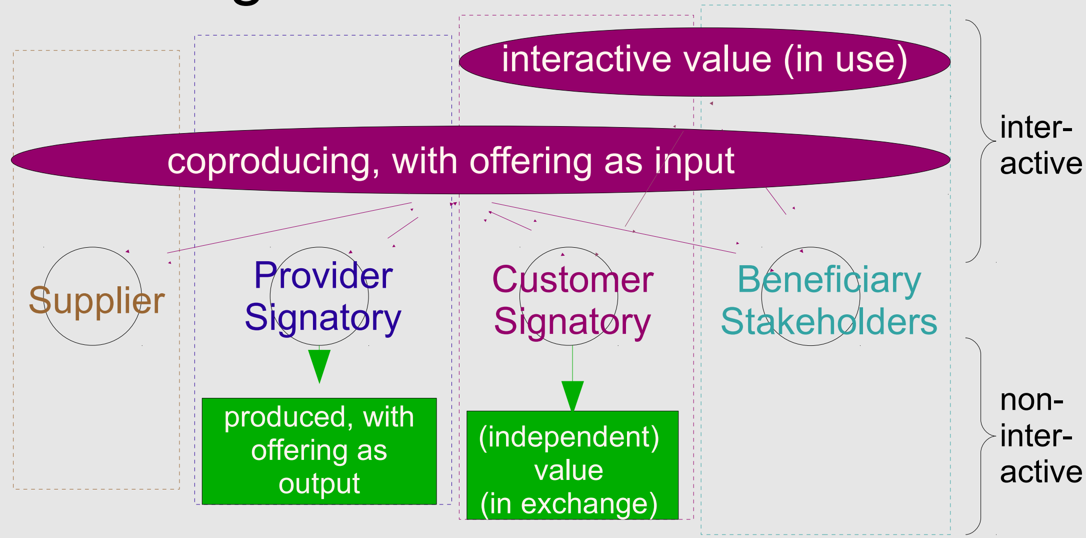
The theory of firms adding ~~value~~ cost has given way to mobilizing customers towards creating their own value

Adding ~~value~~ cost



Our traditional about value … [says] every company occupies a position on the value chain. Upstream, suppliers provide inputs. The company then adds values to these inputs, before passing them downstream to then next actor in the chain [whether another business or the final consumer].

Enabling interactive value creation



… IKEA's strategic intent [is] to understand how customers can create their own value and create a business system that allows them to do it better. IKEA's goal is not to *relieve* customers of doing certain things but to *mobilize* them to do easily certain things they have never done before. Put another way, IKEA invents value by enabling customers' own value-creating activities. … Wealth is [the ability] to realize your own ideas.

Source: Richard Normann and Rafael Ramirez. 1993. "From Value Chain to Value Constellation: Designing Interactive Strategy." Harvard Business Review 71: 65–65. http://hbr.org/1993/07/designing-interactive-strategy .

Basic Concepts. If we are to understand human history as the evolution and design of value-cocreation mechanisms between entities, then where should we begin?

Let's start by understanding the following ten basic concepts:

1.	Resources	Businesses may own physical resources or contract for physical resources, but as a type of resource they are themselves not physical, but instead a conceptual-legal construct. So in the end, all resources fall into one of four types: *physical-with-rights, not-physical-with-rights, physical-with-no-rights, and not-physical-with-rights.*
2.	Service system entities	The most common types of service system entities are people and organizations. New types of service system entities are constantly emerging and disappearing. Recently, open-source and on-line communities have emerged as service systems entities.
3.	Access rights	"By what authority, do you use that resource?" Service system entities have four main types of access rights to the resources within their configuration: *owned outright*, *leased/contracted*, *shared access*, and *privileged access*. Shared access resources include resources such as air, roads, natural language, and internet web sites. Privileged access resources include resources such as thoughts, individual histories, and family relationships.
4.	Value-proposition-based interactions	"I'll do this, if you'll do that." [….] Interactions via value propositions are intended to cocreate-value for both interacting entities. Both interacting entities must agree, explicitly or tacitly, to the value proposition.
5.	Governance mechanisms	"Here's what will happen if things go wrong." [….] If value is not realized as expected, this may result in a dispute between the entities. Governance mechanisms reduce the uncertainty in these situations by prescribing a mutually agreed to process for resolving the dispute.
6.	Service system networks	"Here's how we can all link up." [….] Over time, for a population of entities, the patterns of interaction can be viewed as networks with direct and indirect connectivity strengths. A service system network is an abstraction that only emerges when one assumes a particular analysis overlay on the history of interactions amongst service system entities.
7.	Service system ecology	"Populations of entities, changing the ways they interact." Different types of service systems entities exist in populations, and the universe of all service system entities forms the service system ecology or service world ….
8.	Stakeholders	"When it comes to value, perspective really matters." The four primary types of stakeholders are *customer*, *provider*, *authority*, and *competitor*. In addition … other stakeholder perspectives include employee, partner, entrepreneur, criminal, victim, underserved, citizen, manager, children, aged, and many others.
9.	Measures	"Without standardized measures, it is hard to agree and harder to trust." The four primary types of measures are *quality*, *productivity*, *compliance*, and *sustainable innovation*.
10.	Outcomes	"How did we do? Can this become a new routine or long-term relationship?" […] Beyond a standard two player game, with a customer player and a provider player, ISPAR assumes there exists both an authority player as well as a competitor-criminal player.

Source: Jim Spohrer and Stephen K. Kwan. 2009. "Service Science, Management, Engineering, and Design (SSMED): An Emerging Discipline - Outline & References." *International Journal of Information Systems in the Service Sector* 1 (3): 1–31. doi:10.4018/jisss.2009070101 .

Service systems worldview. These ten basic concepts underlie the *service systems worldview* ...

1. Resources
2. Service system entities
3. Access rights
4. Value-proposition-based interactions
5. Governance mechanisms
6. Service system networks
7. Service system ecology
8. Stakeholders
9. Measures
10. Outcomes

… the world is made up of
populations of service system entities that
interact (normatively) via
value propositions to cocreate-value, but often
disputes arise and so
governance mechanisms are invoked to resolve disputes.

Formal service system entities are types of legal entities with rights and responsibilities, that can own property, and with named identities that can create contracts with other legal entities. [….] Formal service systems exist within a legal and economic framework of contracts and expectations.

Informal service system entities include families ..., open source communities ..., and many other societal or social systems that are governed typically by unwritten cultural and behavioral norms (social systems with rudimentary political systems).

Natural history of service system entities. Service science seeks to create an understanding of the formal and informal nature of service in terms of entities, interactions, and outcomes, and how these evolve (or are designed) over time. An initial premise is that the entities, which are sophisticated enough to engage in rationally designed service interactions that can consistently lead to win-win value cocreation outcomes, must be able to build models of the past (reputation, trust), present, and future (options, risk-reward, opportunities, hopes and aspirations) possible worlds, including models of themselves and others, and reason about knowledge value ….

Source: Jim Spohrer and Stephen K. Kwan. 2009. "Service Science, Management, Engineering, and Design (SSMED): An Emerging Discipline - Outline & References." *International Journal of Information Systems in the Service Sector* 1 (3): 1–31. doi:10.4018/jisss.2009070101 .

Basic questions. A general theory of service system entities and networks formed through value-proposition-based interactions has four parts

… which directly lead to the four basic types of questions that SSMED seeks to answer.

Science

(improve understanding, map natural history, validate mechanisms, make predictions).

What are service system entities, how have they naturally evolved to present, and how might they evolve in the future? What can we know about their interactions, how the interactions are shaped (value propositions, governance mechanisms), and the possible outcomes of those interactions both short-term and long-term?

Management

(improve capabilities, define progress measures, optimize investment strategy).

How should one invest to create, improve, and scale service system networks? How do the four measures of quality, productivity, compliance, and sustainable innovation relate to numerous key performance indicators (KPIs) of business and societal systems? Is there a “Moore’s Law” of service system investment? Can doubling information lead to a doubling of capabilities (performance) on a predictable basis?

Engineering

(improve control, optimize resources).

How can the performance of service system entities and scaling of service system networks be improved by the invention of new technologies (and environmental infrastructures) or the reconfiguration of existing ones? What is required to develop a CAD (Computer-Aided Design) tool for service system entity and service system network design?

Design

(improve experience, explore possibilities).

How can one best improve the experience of people in service system entities and networks? How can the experience of service system creation, improvement, and scaling be enhanced by better design? Can the space of possible value propositions and governance mechanisms be explored systematically?

Sciences of the artificial. Sciences of the artificial are different from natural sciences, and so it becomes especially important to consider these four parts – science, management, engineering, and design – as important knowledge components. In “The Sciences of the Artificial” (Simon 1996), Simon reflects “The world we live in today is much more man-made, or artificial, world than it is a natural world....

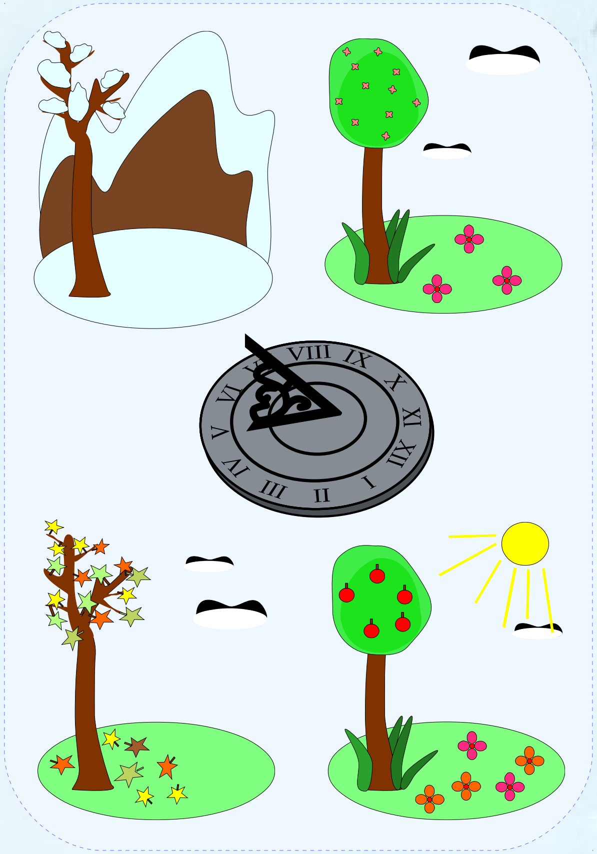
Service Science, Management, Engineering, and Design (SSMED) is emerging as one of the sciences of the artificial. Service science is knowledge about service system entities, value-proposition-based interactions (or value-cocreation mechanisms), governance mechanisms, and the other seven basic concepts. Following Simon even further, one could argue that service system entities are physical symbol systems, dealing with symbols that are named resources, and grounded in physical routines for carrying out the symbolic manipulations related to named resources.

Source: Jim Spohrer and Stephen K. Kwan. 2009. “Service Science, Management, Engineering, and Design (SSMED): An Emerging Discipline - Outline & References.” *International Journal of Information Systems in the Service Sector* 1 (3): 1–31. doi:10.4018/jisss.2009070101 .

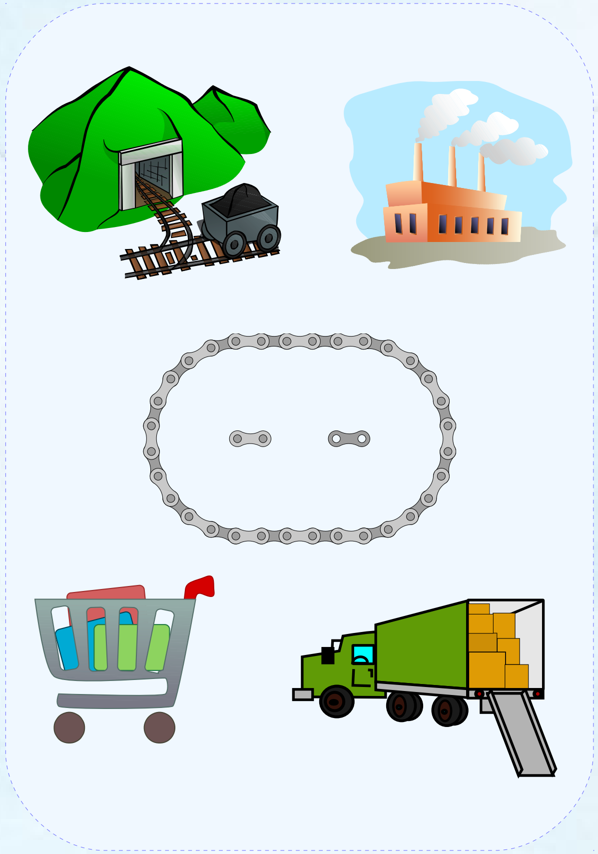
Agenda

1. Systems Sciences
2. SSMED
   (Service Science, Management, Engineering and Design)
3. Service Systems Science
4. Smarter Planet, Smarter Cities
5. Cognitive Era
6. Service Systems Thinking

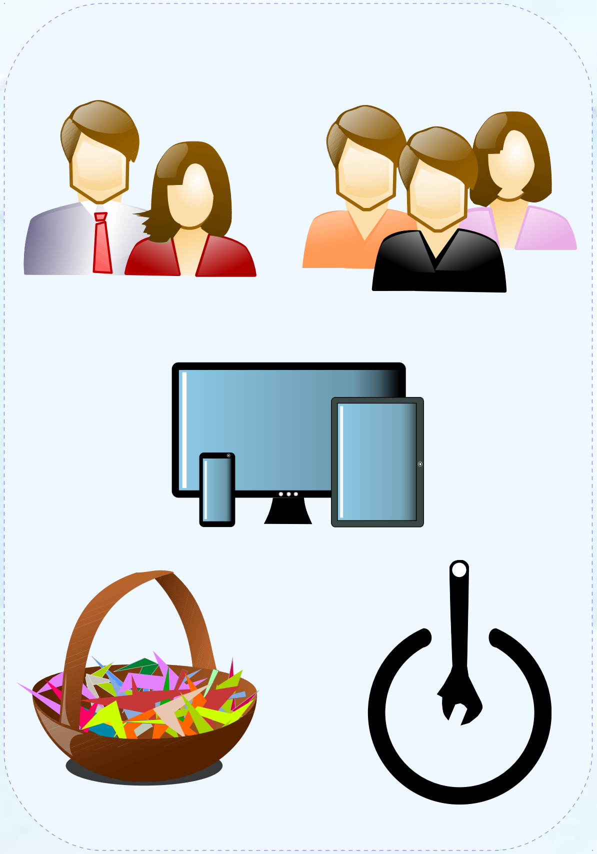
Is thinking different across agricultural systems, industrial systems, and service systems?



Agricultural Systems

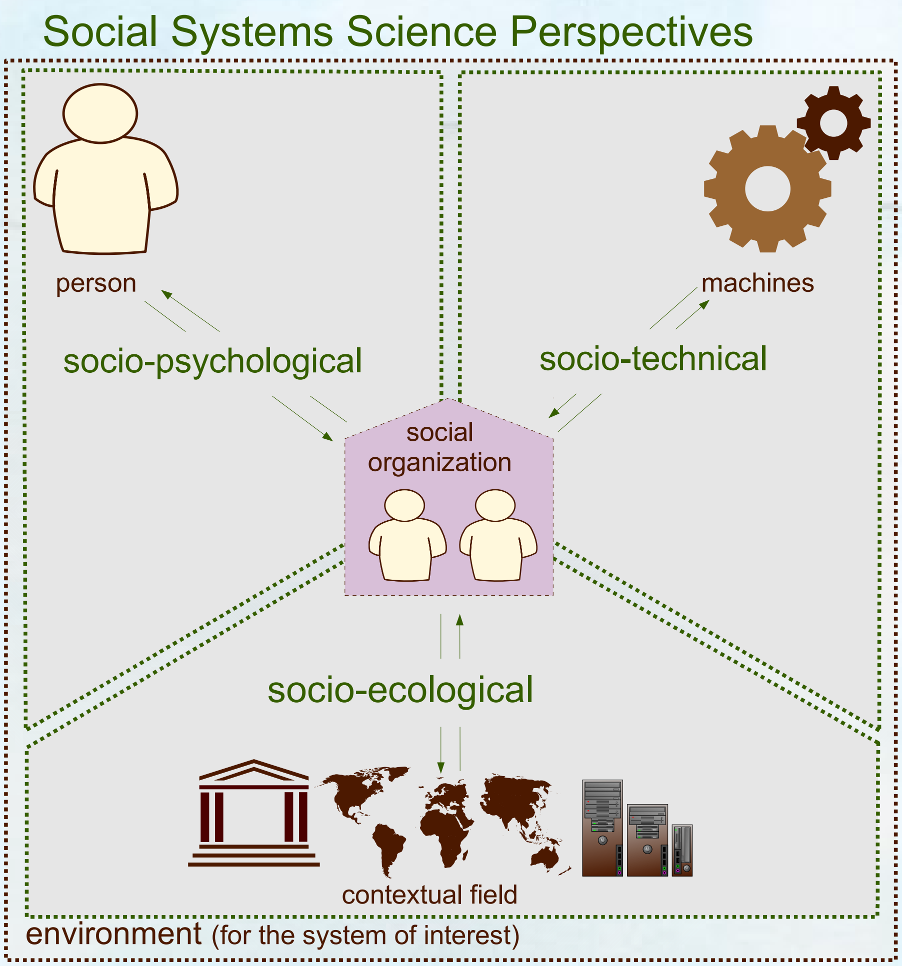


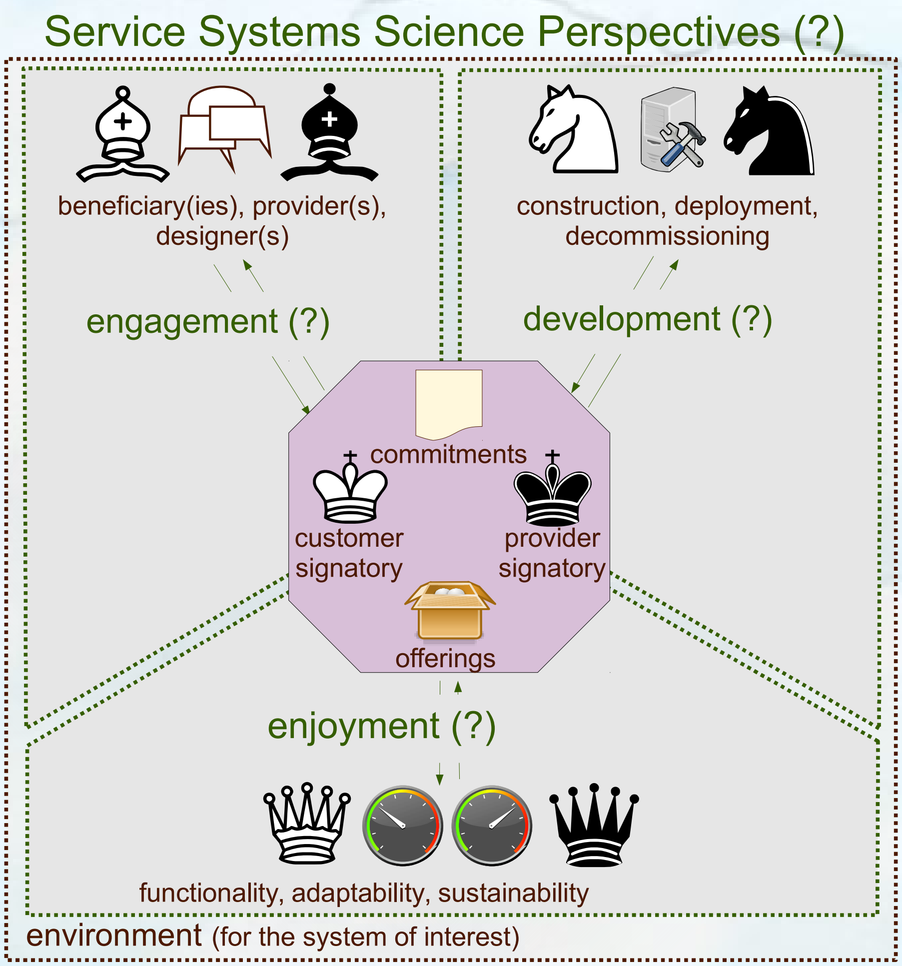
Industrial Systems



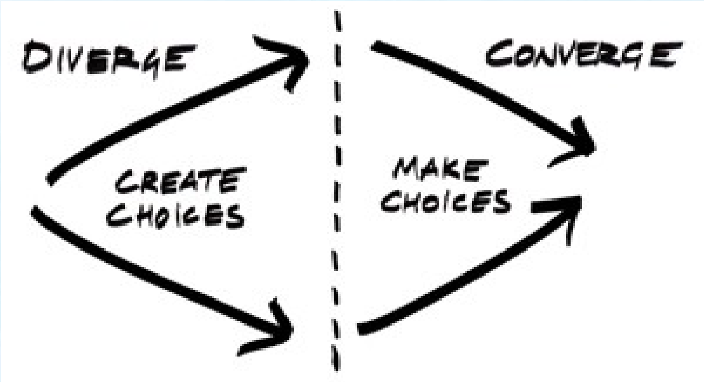
Service Systems(?)

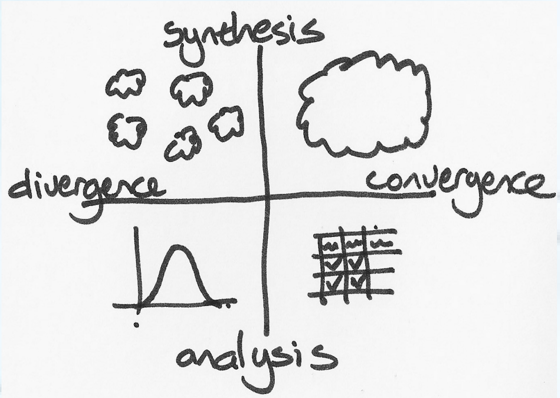
Can we build on Social Systems Science towards a new Service Systems Science?





Design Thinking: Divergent-Convergent, Synthesis-Analysis





Design thinking is different and therefore it feels different.

Firstly it is not only convergent. It is a series of divergent and convergent steps. **During divergence we are creating choices and during convergence we are making choices**. For people who are looking to have a good sense of the answer, or at least a previous example of one, before they start divergence is frustrating. It almost feels like you are going backwards and getting further away from the answer but this is the essence of creativity. Divergence needs to feel optimistic, exploratory and experimental but it often feels foggy to people who are more used to operating on a plan. Divergence has to be supported by the culture.

The second difference is that design thinking relies on **an interplay between analysis and synthesis, breaking problems apart and putting ideas together**. Synthesis is hard because we are trying to put things together which are often in tension. Less expensive, higher quality for instance. [….]

Designers have evolved visual ways to synthesize ideas and this is another one of the obstacles for those new to design thinking; a discomfort with visual thinking. A sketch of a new product is a piece of synthesis. So is a scenario that tells a story about an experience. A framework is a tool for synthesis and design thinkers create visual frameworks that in themselves describe spaces for further creative thinking.

Source: Tim Brown "What does design thinking feel like?" *Design Thinking* (blog), Sept. 7, 2008 at http://designthinking.ideo.com/?p=51 ; "Why Social Innovators Need Design Thinking", *Stanford Social Innovation Review*, Nov. 15, 2011 at http://www.ssireview.org/blog/entry/why_social_innovators_need_design_thinking .

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?

Interdependencies of Systems Engineering and Systems Science

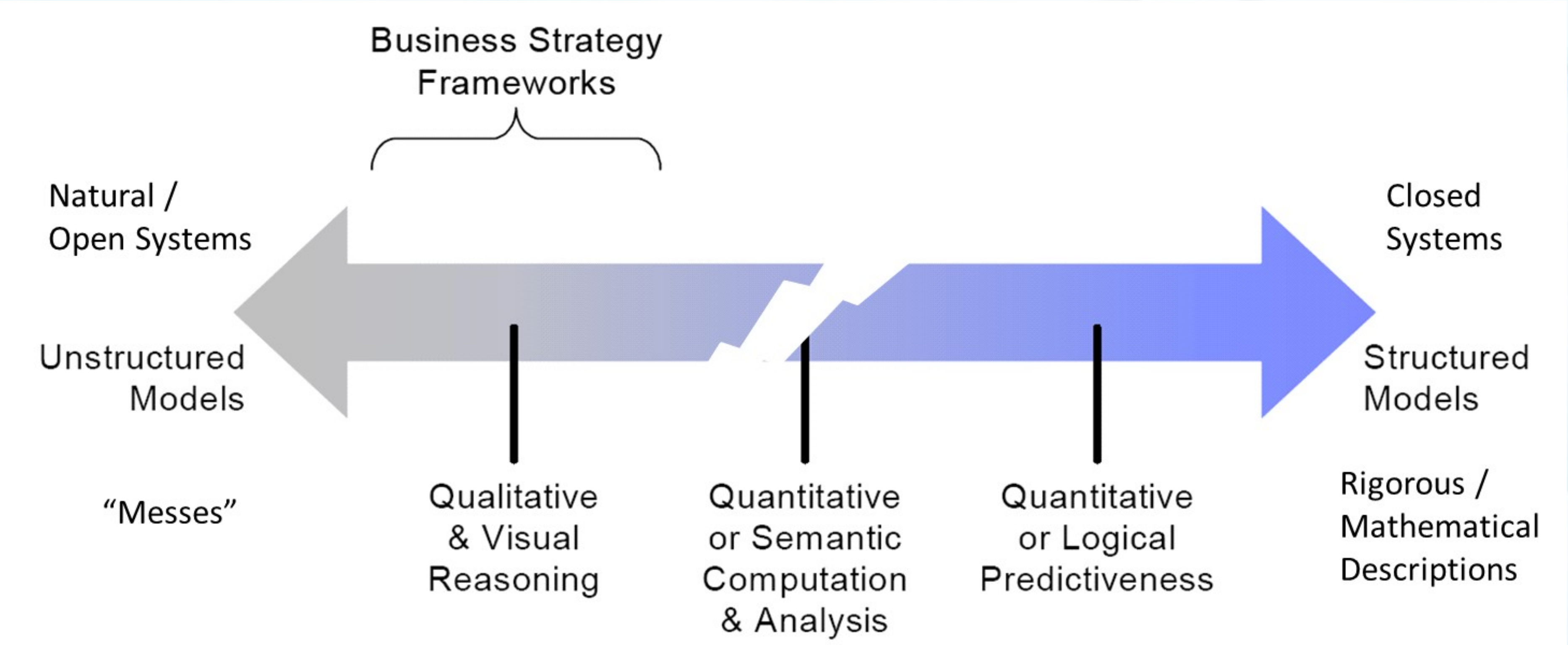


Figure 1. Diagram describing a spectrum of models, from conceptual to rigorous. Adapted from IBM Research. 2006 Services science: A new academic discipline? http://www.almaden.ibm.com/asr/resources/facsummit.pdf, p. 49.

Systems Science Working Group

Home

This is the Wiki site for the Systems Science Working Group (SSWG) of INCOSE. The SSWG is led by James Martin (martinqzx@gmail.com) with Duane Hybertson as co-leader (dhyberts@mitre.org). The purpose of the SSWG is to promote the advancement and understanding of Systems Science and its application of Systems Theories to SE. We have the following objectives:

- Encourage advancement of Systems Science principles and concepts as they apply to Systems Engineering.
- Promote awareness of Systems Science as a foundation for Systems Engineering.
- Highlight linkages between Systems Science theories and empirical practices of Systems Engineering.

The WG has about 100 members who have access to the Discussion List at syssciwg@googlegroups.com, which can be reached through the hyperlink on the lower left. If you wish to become a member of this WG, please send a request to systems-science@incose.org, or you can join directly from our discussion list page.

The International Council on Systems Engineering (INCOSE) is a not-for-profit membership organization founded in 1990. Our mission is to share, promote and advance the best of systems engineering from across the globe for the benefit of humanity and the planet. This WG is a joint activity of INCOSE and the International Society for the Systems Sciences (ISSS). See the joint agreement MOU here.

Here is our WG page on the INCOSE website.

Agenda

1. Systems Sciences
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IBM's Global Innovation Outlook (GIO)

Over five years ago, IBM launched a unique experiment in exploration, collaboration and innovation: the Global Innovation Outlook (GIO). During its evolution, we've convened hundreds of thought leaders, policymakers, business executives, university researchers and representatives from non-profit organizations. We've explored topics as varied and important as healthcare, energy and the environment, economic development in Africa, and the future of the world's water resources. We've shared the results of our exploration and analysis through reports and studies, brokered new relationships, and launched dozens of collaborative initiatives among GIO participants.

Today the GIO's approach pervades just about all IBM interactions. It is clearly visible in our thinking about building a Smarter Planet, and our implicit invitation for like-minded people around the world to join us in this endeavor.

Engage with IBM at any level today, and you will witness this belief in action, as well as the culture it engenders. Therefore, the GIO itself is no longer necessary as a standalone program, and we will no longer be conducting separate GIO deep dives, roundtables or forums as such. We will, however, continue to support and cultivate the communities essential to the spirit of the GIO, including the GIO Facebook and LinkedIn communities, so that GIO alumni can contact each other and IBM as often as they wish. GIO reports and other collateral material will also remain available. And the GIO blog archives will continue to be hosted at www.gio.typepad.com (link resides outside of ibm.com).

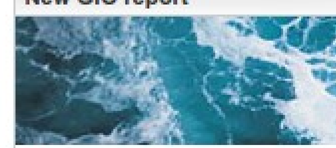
We encourage you to continue to engage with us at IBM, as well as your fellow GIO Alumni. Feel free to share any observations, interests or suggestions about the GIO, innovation, or the quest

Contact us

Questions? E-mail the GIO Team

E-mail us

New GIO report



Read GIO Security, Privacy, and Web 2.0 Report (2.62MB)


GLOBAL INNOVATION OUTLOOK
2004
IBM

GLOBAL INNOVATION OUTLOOK

2004

INNOVATION IN A NEW CENTURY

The greatest innovation in human history had little to do with tools or technology.

MORE THAN THE FIRST WHEEL — MORE THAN EVEN THE HARNESSING OF FIRE — LANGUAGE PROVIDED THE FOUNDATION ON WHICH ALL FUTURE PROGRESS OF HUMAN CIVILIZATION WOULD BE BUILT.

As simple a notion as that may be, it holds lessons about innovation that we at the beginning of the 21st century would do well to consider: innovation requires human interaction and broad-scale adoption, and is almost always more about what we do with an idea than the idea itself.

We at IBM have tried to consider this as we launch our first ever Global Innovation Outlook, a worldwide conversation to examine the changing nature of innovation and the areas in which it might generate the greatest benefit for business and society.

It's easy to understand why we may have mistaken invention for innovation after two centuries of amazing accomplishment.

We begin the 21st century with a general expectation that the one-two punch of science and technology will, by itself, generate an unending flow of discoveries, tools and gadgets to bring us closer to a utopian future. This premise has also shaped a general understanding of innovation as equivalent to discovery, invention and the flow of new technotoys. In reality, invention has always been as distinct from innovation as rivers are from oceans: one clearly feeds into the other.

A great idea or brilliant new technology that never influences or effects change simply doesn't matter. For speech, shaping sounds to words was not enough: the innovative power of language grew out of its collaborative nature, the accepted standards it generated and depended upon, and its ability to bridge the worlds of thought and action.

This is why we must define 21st century innovation as beginning at the intersection of invention and insight: we innovate when a new thought, technology, business model or service actually changes society.

SONY CORPORATION
JAPAN

John Furth
Chief Strategist,
Global Hub

"I think most people when they think innovation immediately think technology, when indeed innovation can be anything. It can be a marketing innovation, a financing model, it could be the way you run your life…"

RENSSELAER
POLYTECHNIC INSTITUTE
USA

James Tien, Ph.D.
Professor,
Decision Sciences and Engineering Systems

"Innovation in this century, as compared to the last century or previous centuries, has obviously changed. One of the most obvious things that has changed is that the time between innovations is shorter."

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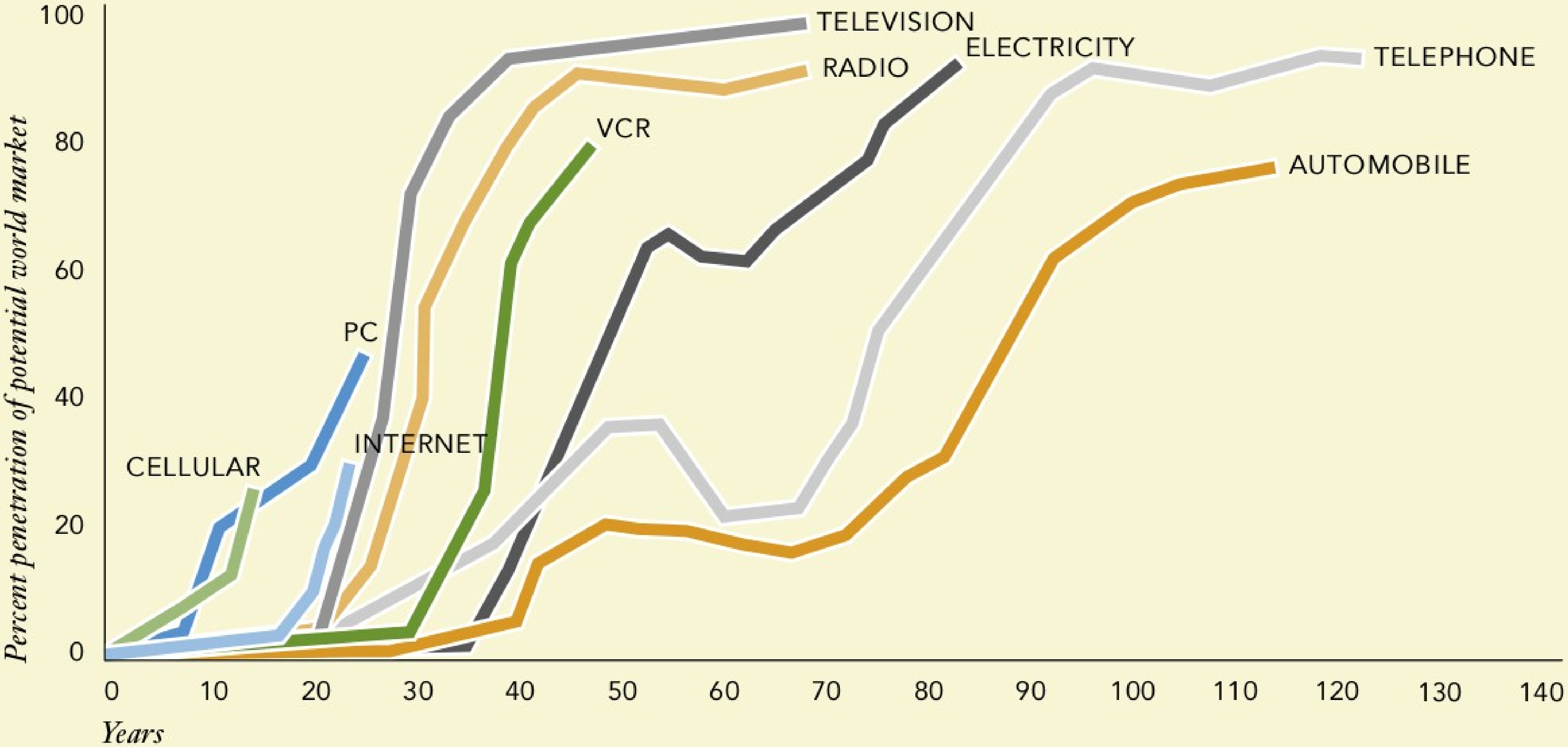
But it's not just our understanding of innovation that needs adjusting — innovation itself is changing in at least three major ways.

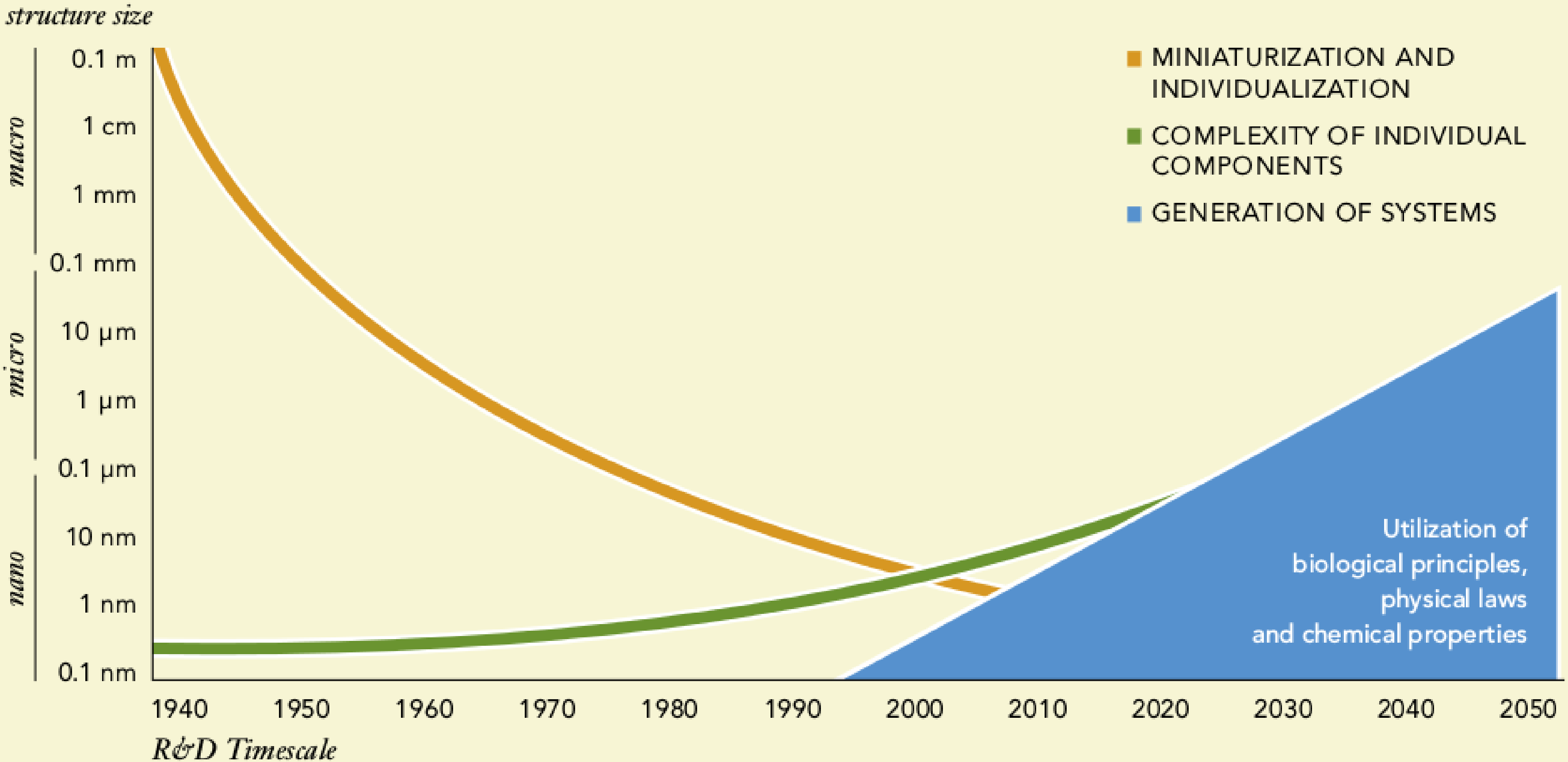
PACE OF INNOVATION ACCELERATING

Newer technologies taking hold at double or triple previous rates



INNOVATION WILL REQUIRE MULTIDISCIPLINARY APPROACHES

Example: Nanotechnology



Wider collaboration is essential to innovation in many fields. In nanotechnology, for instance, insights from many scientific disciplines—including biology, which is ruled by molecular self-assembly—will soon help

one:

It is occurring more rapidly—barriers of geography and access have come down, enabling shorter cycles from invention to market saturation.

two:

It requires wider collaboration across disciplines and specialties—where until recently, people hunkering down in a garage could create a new technology that would sweep the world, many challenges are now too complex to be solved by individual pockets of brilliance, let alone brilliant individuals. Combinations of technologies, expertise, business models and policies will now drive innovation.

three:

The concept of intellectual property is being reexamined in the light of these collaborative demands. Increasingly, entities that treat intellectual assets more like capital—something to be invested, spread, even shared to reap a return, not tightly controlled and hoarded—will find the clearest paths to success.

This is fine in theory, but what does it imply for the practice of innovation? This question led directly to the creation of the Global Innovation Outlook (GIO).

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So after careful consideration, we selected three topics that seemed to hold the most potential to improve the quality of lives across the world as well as stimulate significant economic opportunity:

Healthcare

page 20

Government and Its Citizens

page 38

The Business of Work and Life

page 54


Global
Innovation
Outlook
2.0

Index of insights

Smarter Planet

In the fall of 2008, in the midst of a global economic crisis, IBM began a conversation with the world about the promise of a smarter planet and a new strategic agenda for progress and growth.

System of Systems

CFR Events

November 6, 2008

A Smarter Planet

Speaker:

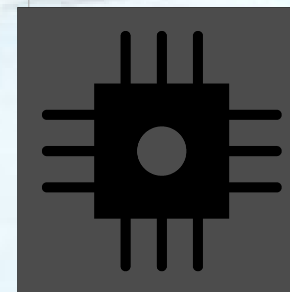
Samuel J. Palmisano
Chairman, President, and Chief Executive Officer, IBM Corporation

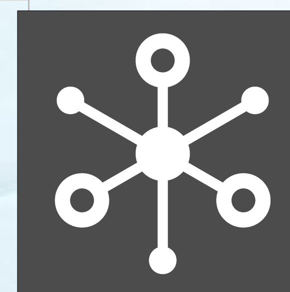
Presider:

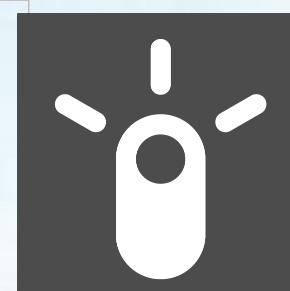
Robert E. Rubin
Chairman and Senior Counselor, Citigroup

The unobservable becoming observable

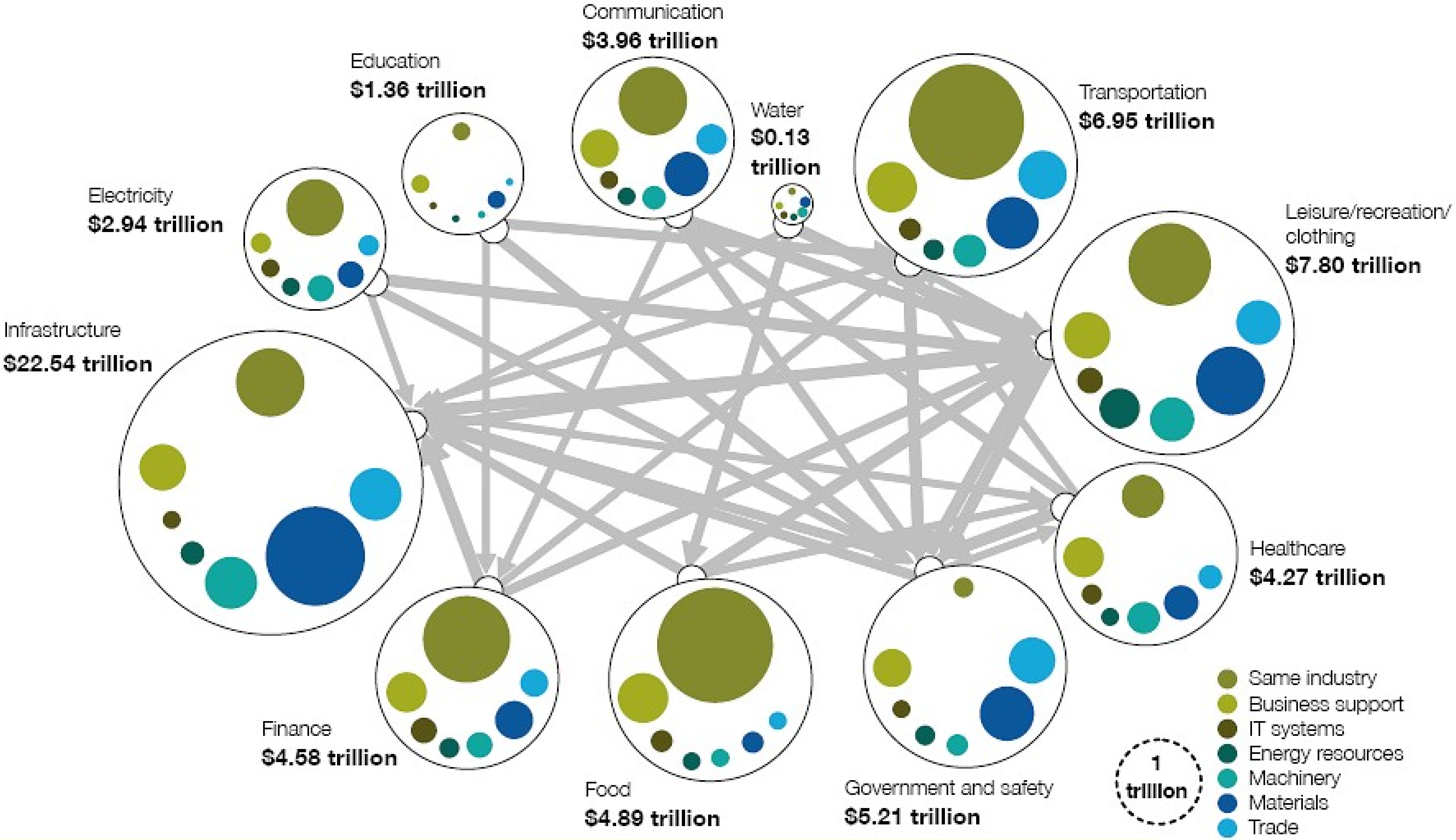
Pre-digital physical infrastructure	*Converging physical and digital infrastructure*
World as invisible or unobserved	Our world is becoming INSTRUMENTED
Analog / synchronous connections, person-to-person and machine-to-machine	Our world is becoming INTERCONNECTED
Things as dumb or unresponsive to interaction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







US$54 trillion system of systems -- IBM

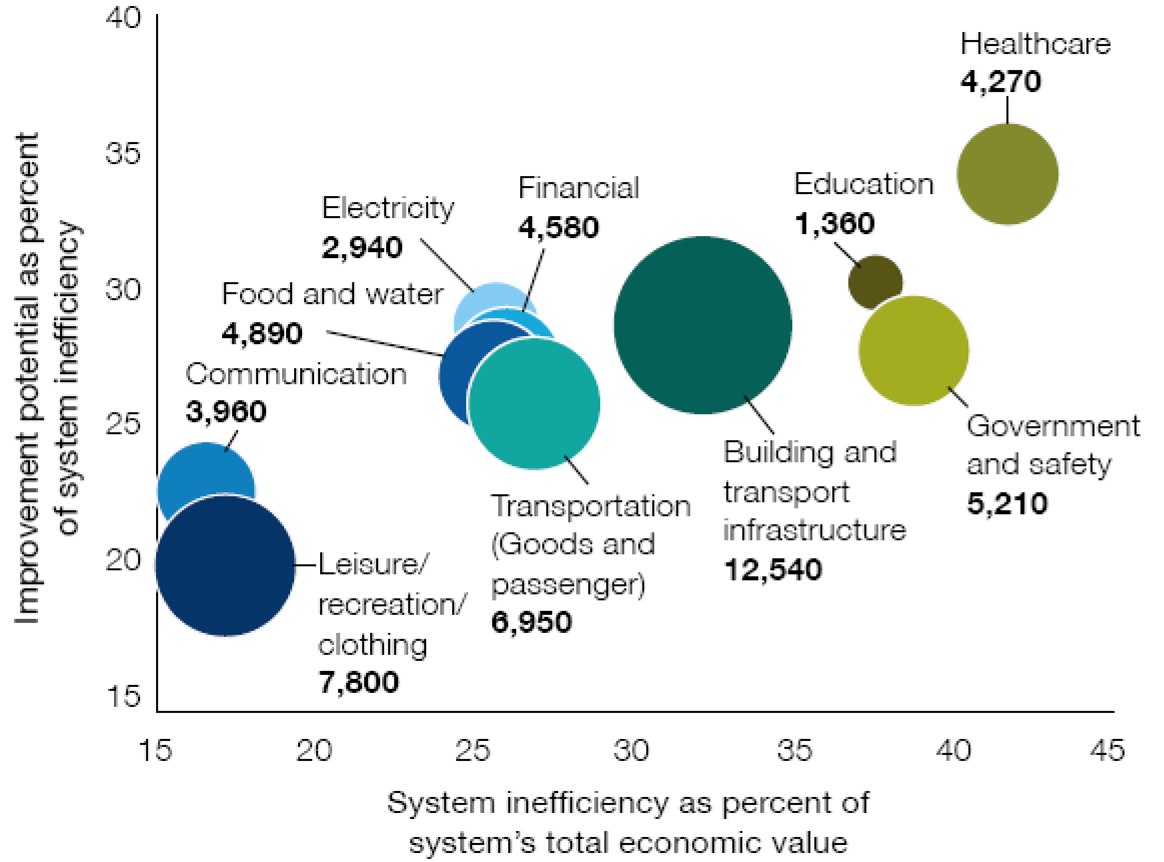


http://www-935.ibm.com/services/us/gbs/bus/html/ibv-smarter-planet-system-of-systems.html.

Note: Size of bubbles represents systems' economic values. Arrows represent the strength of systems' interaction.
Source: IBM Institute for Business Value analysis of Organisation for Economic Co-operation and Development (OECD) data.

Figure 1: We live and work within a complex, dynamic and interconnected US$54 trillion system of systems.

The world's $4 billion challenge -- IBM



Note: Size of the bubble indicates absolute value of the system in US$ billions
Source: IBM Institute for Business Value analysis based on inefficiency and improvement potential estimates reported during 2009 survey of 518 economists.

http://www-935.ibm.com/services/us/gbs/bus/html/ibv-smarter-planet-system-of-systems.html.

Figure 2: Of the US$15 trillion in inefficiencies within our global system, approximately US$4 trillion could be eliminated.

Smarter Planet

IBM believed there was an opportunity to address the problems and challenges that were gripping the world. This was a world IBM saw becoming more intelligent before its eyes—from smarter power grids, to smarter food systems, smarter water, smarter healthcare and smarter traffic systems. Computational power was being infused into things no one would recognize as computers—phones, cars, roads, power lines, waterways and food crates. And with more information and data being captured than ever before, sophisticated analytics and algorithms were being developed that could make sense of it all.

Smarter Planet became the overarching framework for IBM's growth strategy, and it prompted forward-thinking leaders and citizens around the world to consider innovative ideas such as traveler-centric transportation, consumer-centric electric power, and intelligent systems for managing healthcare, water, public safety and food.

Within just a year after IBM's Smarter Planet initiative was launched, hundreds of IBM clients seized upon new capabilities to build smarter systems, and began achieving measurable benefits for their companies, communities and cities.

In Spain, eight hospitals and 470 primary care clinics implemented smarter healthcare systems across their facilities—and improved clinical results and operational efficiency by up to 10 percent. In a study of 439 cities, those that employed smarter transportation solutions reduced travel delays on average by more than 700,000 hours daily. And four leading retailers reduced supply chain costs by up to 30 percent, reduced inventory levels by up to 25 percent, and increased sales by up to 10 percent by analyzing customer buying behaviors, aligning merchandizing assortments with demand and building end-to-end visibility across their entire supply chain.

Smarter Planet

In 2009, IBM launched its Smarter Cities campaign, a comprehensive approach to helping cities run more efficiently, save money and resources, and improve the quality of life for citizens. Throughout 2009, IBM held nearly 100 Smarter Cities Forums around the world, attended by thousands of leaders, who gathered to explore ways in which they could transform the complex systems that facilitate life in cities, including making optimal use of all the interconnected information available.

IBM knew that in order to help cities tackle thorny challenges—from traffic congestion, to energy use, to the building of sustainable communities—a new set of skills would be required. So in 2010, it began working with colleges and universities to help give students access to technologies and training to learn new skills and help put them to work in cities around the world.

These collaborations and the strategy are paying off for IBM. In 2010, IBM's Smarter Planet initiative generated US$3 billion in revenue and double-digit growth from more than 6000 client engagements. And more than 25 percent of work at IBM ® Research was on Smarter Planet projects, which IBM is in the process of doubling to 50 percent, in areas such as mobile web, nanotechnology, stream computing, analytics and cloud.

IBM believed t
that were gripp
intelligent befc
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power was bei
phones, cars, r
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costs by up to
increased sales
aligning merch
visibility acros

Smarter Cities Challenge

In 2010, IBM Citizenship created the Smarter Cities Challenge to help 100 cities over a three-year period to address some of the critical challenges facing cities. We do this by contributing the time and expertise of our top experts from different business units and geographies, putting them on the ground for three weeks to work closely with city leaders and deliver recommendations on how to make the city smarter and more effective.

We have learned a tremendous amount about the challenges facing today's cities and how IBM, through the expertise of its employees, can add value as city leaders look for solutions. In particular, we have found that cities are most often struggling to:

Do more with less

In today's difficult global economy, municipal governments are struggling with demands to increase basic services and to do so with fewer available resources. Smarter Cities Challenge teams from Newark to Mecklenburg County have delivered recommendations that are helping these cities make smarter, more strategic investments in their communities, maximizing value in the long term.

Bridge silos in information and operations

Even as cities tackle issues that cut across segments of society - for example, transportation policies that affect economic development - their operations are organized and their data is collected separately. Our work in cities like St. Louis, Providence and Ho Chi Minh City has revealed that changes in technology, data analytics and other tools can help cities bridge those gaps and enhance collaboration across departments.

Use civic engagement to drive better results

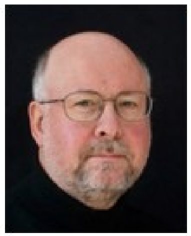
When cities contemplate new ways to deliver basic services, support from their citizens is essential to their success. Citizens who are uninformed or disengaged cannot support, and may actively oppose, even the best policies. In collaboration with their IBM teams, cities like Guadalajara, Townsville and Sendai are reimagining their relationships with citizens, leveraging them as both sources of data - the pulse of the city - and as partners in seeding change.

Invest in infrastructure for better management

Many of today's cities are suffering from years of disinvestment in basic infrastructure, and especially technology infrastructure. These gaps, due in part to budgetary pressure but also to the regular turnover of leadership, have kept cities, their leaders and citizens from realizing their full potential, slowing economic development and constraining their ability to make informed, data-driven decisions. Smarter Cities Challenge engagements all over the world are demonstrating how the right investments in infrastructure can introduce long-term efficiencies and dramatically transform a city's prospects for growth.

Smarter Planet

Colin Harrison



Colin Harrison invented the Smarter Cities technical architecture.

An IBM distinguished engineer, Colin Harrison currently leads IBM's Enterprise Initiatives team working on the cross-IBM technical coordination of the Smarter Cities offerings. He is the creator of the Smarter Cities technical architecture, and was a principal contributor to establishing a global business team for Smarter Cities and for communicating the technical vision to IBM's clients. Harrison has held a number of executive roles at IBM, including director of strategic innovation in IBM's Integrated Technology Delivery in Europe and director of global services research in IBM's Research Division, where he held many leadership positions. Harrison joined IBM in San Jose, California, in 1979. In 2004, he was named an IBM Master Inventor for his sustained innovation leadership and service.

Jon Iwata

John Kennedy

Stan Litow

Sam Palmisano

Jurij Paraszczak

Ann Rubin

Mike Wing

Colin Harrison

Jon Iwata

John Kennedy

Stan Litow

Sam Palmisano

Jurij Paraszczak

Jurij Paraszczak is director of IBM Research Industry Solutions and leader of the Research Smarter Cities program, which helps cities optimize their infrastructures. He is responsible for aligning IBM's 10 research laboratories with Smarter Cities opportunities emerging throughout the world. In addition, he integrates research capabilities in materials and processes, IT innovation, modeling and optimization to implement sustainable solutions for IBM customers across diverse industries. Paraszczak holds nearly 20 patents in a wide variety of fields including communications, materials manipulation, media delivery and more.

Ann Rubin

Mike Wing

Smarter cities for smarter growth

How cities can optimize their systems for the talent-based economy

How to make your city smarter: Creating and assessing the path to prosperity

More than ever, the traditional "bricks-and-mortar" drivers of economic growth are giving way to an economy based on "brains and creativity." Competitive differentiation today is more likely to be based on the ability of the workforce to create and absorb skills and innovation than on traditional drivers such as available natural resources, physical labor or manufacturing prowess. As a result, the skills, aptitude, knowledge, creativity and innovation of a workforce – which collectively can be viewed as the talent pool in the economy – have become increasingly important drivers of economic growth and activity.

Cities, as hubs of the global economy, are the focal points for this transformation. In the immediate future, three interconnected factors will place even more emphasis on the role of cities in talent-based economic development:

To learn more

- Download the complete IBM Institute for Business Value executive report: "Smarter cities for smarter growth: How cities can optimize their systems for the talent-based economy." (2.42MB)
- Download the executive summary (749KB)
- Listen to an interview with the author MP3, 4.2MB

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Meet the authors

Mary Keeling
Manager, IBM Institute for Business Value Center for Economic Analysis

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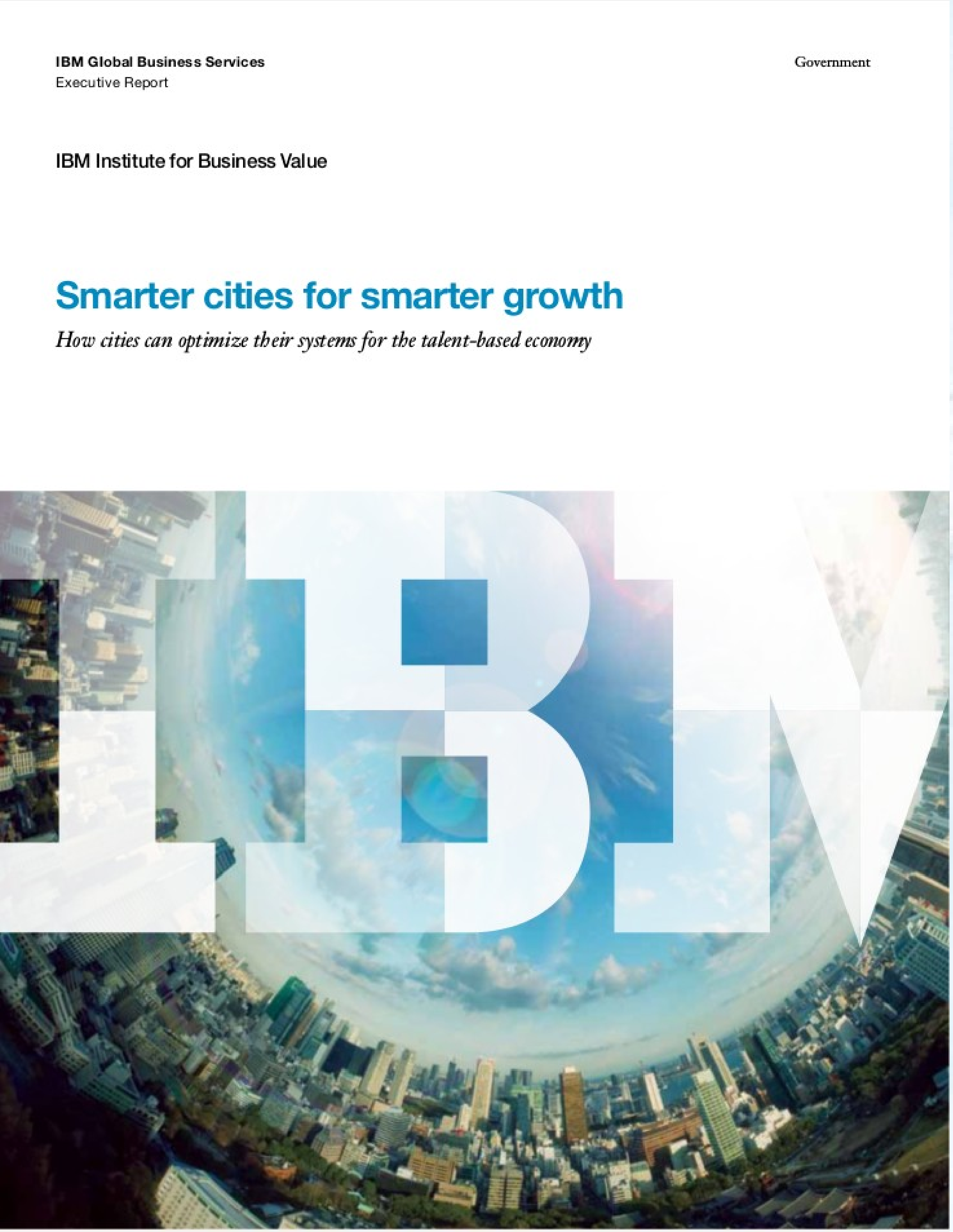

IBM Global Business Services
Executive Report

Government

IBM Institute for Business Value

Smarter cities for smarter growth

How cities can optimize their systems for the talent-based economy

February 2016

IBM Global Business Services
Executive Report

IBM Institute for Business Value

Smarter cities for smarter growth

How cities can optimize their systems for the talent-based economy

A critical question facing cities, though, is how do the cities apply the steps and principles outlined above *in the most cost-effective and productive fashion*? The answer is to focus initially on four high-impact areas of improvement:

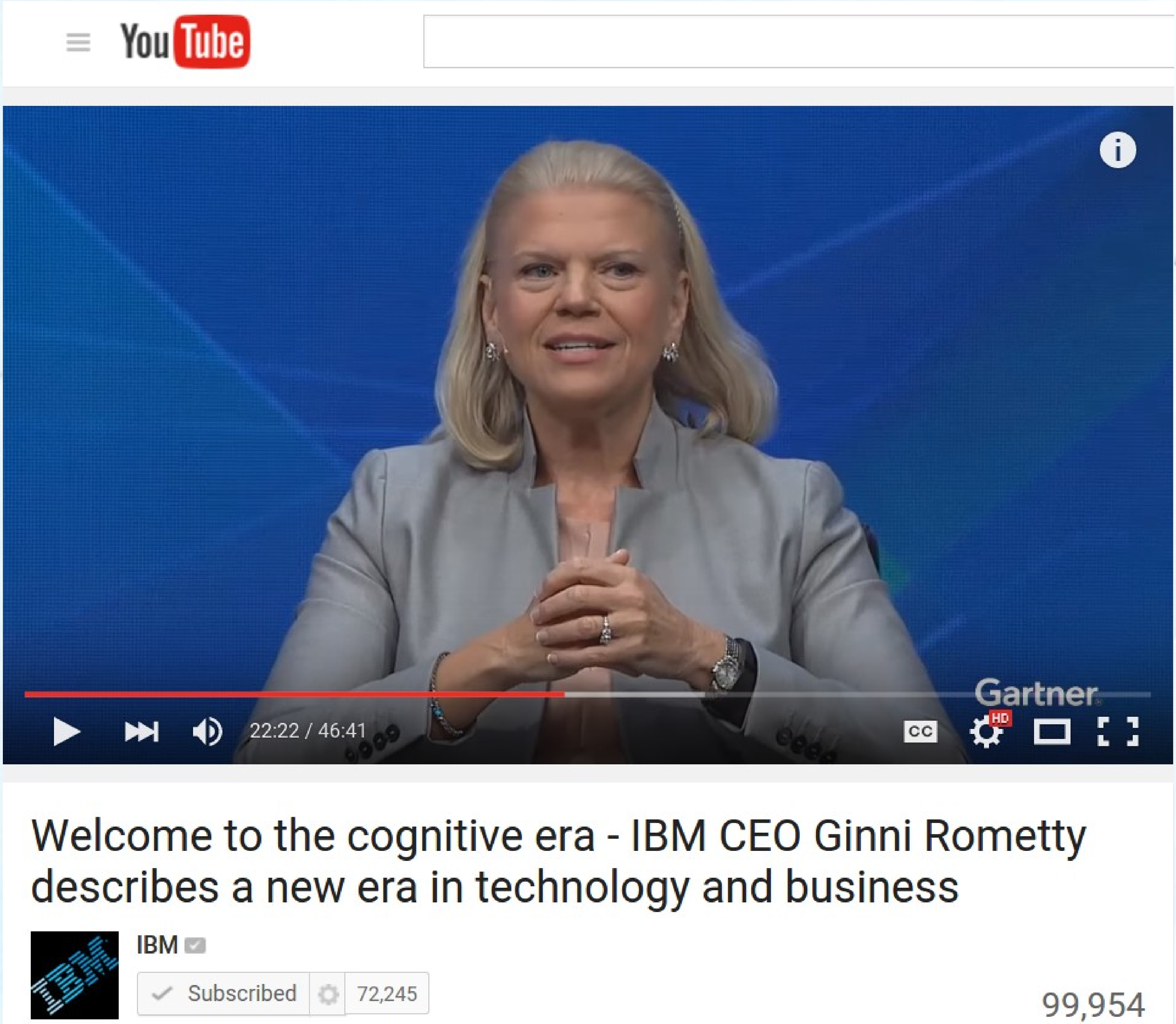
- Reduce congestion in transport systems
- Improve public safety by reducing crime and emergency response time
- Streamline and tailor services for the citizen, including a heavy emphasis on education and training
- Enable appropriate access to healthcare data for better quality of care, early disease detection and prevention.

In addition, cities will need to continue building on other core services agendas such as energy, water and environmental sustainability, urban planning and architecture.

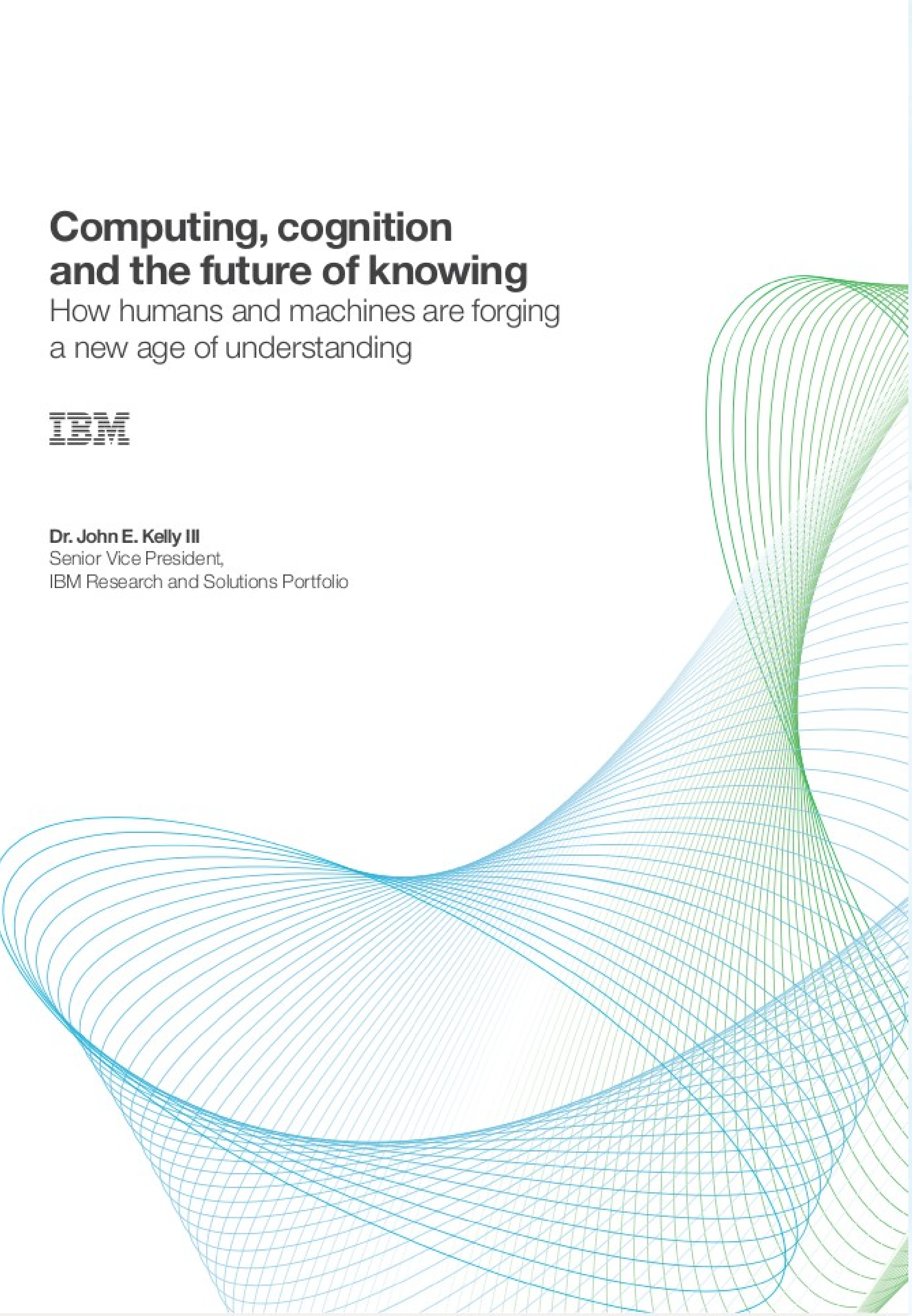
They will also cultivate a systems-level view of the entire city that allows them to capture the most value from their investments, optimizing improvements across different parts of the city. They will need to better understand behavior patterns in their systems and not just respond to events. Such improvements will derive from applying advanced technology capabilities – collecting and managing the right kinds of data, analyzing patterns in it and then optimizing system behaviors based on that analysis – as well as the policies that enable them.

Agenda

1. Systems Sciences
2. SSMED
   (Service Science, Management, Engineering and Design)
3. Service Systems Science
4. Smarter Planet, Smarter Cities
5. Cognitive Era
6. Service Systems Thinking



Ginni Rometty, Keynote Interview, Gartner Symposium/Itxpo 2015, October 4, republished at https://www.youtube.com/watch?v=bMLYKhiZCVI



Cognitive computing refers to systems that learn at scale, reason with purpose and interact with humans naturally. Rather than being explicitly programmed, they learn and reason from their interactions with us and from their experiences with their environment. […]

Those systems have been deterministic; cognitive systems are probabilistic. They generate not just answers to numerical problems, but hypotheses, reasoned arguments and recommendations about more complex — and meaningful — bodies of data.

From the 2015 Cognitive_Colloquium^{SF}, at
http://research.ibm.com/cognitive-computing/#sf,

Image 1

The Tabulating Era (1900s–1940s)

- Single purpose mechanical systems
- Essentially calculators

The Programming Era (1950s–present)

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

The Cognitive Era (2011–)

- Man-computer symbiosis in cooperative interaction (Licklider)
- (1) let computers facilitate formulative thinking, as they now facilitate the solution of formulated problems; and
- (2) enable men and computers to cooperate in making decisions and controlling complex situations without inflexible dependence on predetermined programs ...

Predictions: Courses & Cognitive (Jim Spohrer, IBM)

2015	2025	2035	...	2055

2015 — Course: "How to build a cognitive system for Q&A task"

- 9 months for 40% question answering (Q&A) accuracy for corpus / textbook
- 1-2 years for 90% accuracy, mostly which user questions to reject

2025 — Course: "How to use a cognitive system to be a better professional X"

- Tools to build a student level Q&A from textbook in one week

2035 — Course: "How to use your cognitive system to build a unicom startup"

- Tools to build faculty level Q&A for textbook in one day
- Most people have at least one cognitive assistant working for them
- A cognitive mediator knows a person better than they know themselves

2055 — Course: "How to manage your workforce of cognitive assistants"

- Most people have 100 cognitive assistants working for them

Cognitive Mediators:

Cognitive systems with deep knowledge of both customer (user) and provider (expert) as co-creators of win-win value

Smart Service System:

All entities in network use cognitive mediators to enhance value co-creation interactions

Jim Spohrer. 2016. "Open Innovation & Singularity: The Future of Industries & Business Models." Panel discussion presented at HICSS, Kauai, Hawaii, January 5. http://www.slideshare.net/spohrer/spohrer-hicss-20160105-v2.

Open Innovation Leveraging IBM Watson

UGBA 198 - 3 Units: Fall 2014

Class Times: TTH 8:00am – 9:30am. Tuesdays: C-250s Thursdays: I - Lab

Instructors:	Solomon Darwin / Donald Wroblewski
E-mail Address:	darwin@haas.berkeley.edu / dewroblewski@berkeley.edu
Office Hours:	By appointment
Prerequisites:	Instructor approval is needed for registration.
Advisors:	Ken Singer, Henry Chesbrough, Jim Spohrer and Nanci Knight
Textbooks:	1) IBM resources listed on the back page 2) Open Business Models. Author: Henry Chesbrough

The objective of the course is to offer technical and business students access to the Watson Developer Cloud to learn about the technical aspects of cognitive computing, including ingesting, building and training a corpus, and then in the second half of the semester, using that information to build a cognitive app and developing a business model as a precursor to taking their ideas to market.

The course is intended to help educate and empower the next generation of innovators with an opportunity to 'change the world' with their access to Watson. The students taking this course will be among the first to have hands-on access to the cutting-edge Watson technology, enabling them to develop innovative ideas to solve the most pressing problems of industry and society. And from a skills perspective this course will further enhance the students' marketability. Gartner Inc., a research firm predicts that 4.4 million IT jobs will be created to support Big Data by 2015.

Course Objectives:

1. Understand Watson and its underlying technologies
2. Develop an abstract of a Watson application that solves a real world challenges
3. Formulate a value proposition and identify the target consumers or audiences
4. Develop a corpus of data in a domain with types of text content in format supported by Watson
5. Understand how corpora is ingested and trained for accuracy.
6. Come up with Question/Answer pairs and do some training and scoring
7. Build a Mobile application prototype for use with corpus
8. Develop a business model to take the application to market (to capture the value created)

Identify a Real World Challenge → **Develop: Solution that Leverages IBM Watson** → **Propose a Business Model**

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Open Innovation Leveraging IBM Watson

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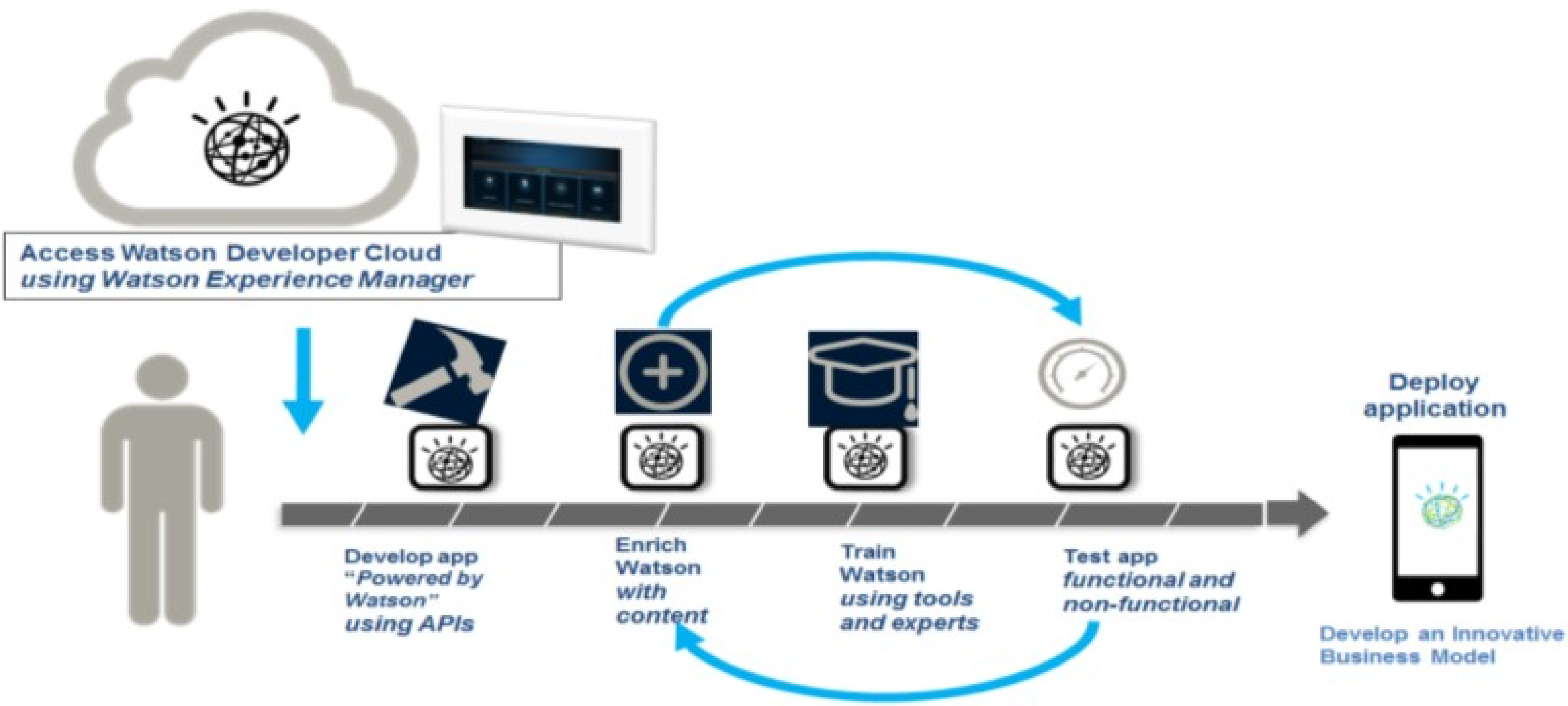
The process for building your "Powered by Watson" app



4. Develop a corpus of data in a domain with types of text content in format supported by Watson
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6. Come up with Question/Answer pairs and do some training and scoring
7. Build a Mobile application prototype for use with corpus
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Identify a Real World Challenge ⟶ **Develop: Solution that Leverages IBM Watson** ⟶ **Propose a Business Model**

Tentative Schedule

UGBA198 - TTh 8:00-9:30PM meets in C250 on Tusesdays and in I-Lab on Thursdays

Week	Tue	Thur	Topic for Disccussion
1		28-Aug	Introduction to Watson - Speaker from IBM
2	2-Sep	4-Sep	Topics related to Module 1 - guest speaker TBD
3	9-Sep	11-Sep	Topics related to Module 1 - guest speaker TBD
4	16-Sep	18-Sep	Topics related to Module 2 - guest speaker TBD
5	23-Sep	25-Sep	Topics related to Module 2 - guest speaker TBD
6	30-Sep	2-Oct	Topics related to Module 3 - guest speaker TBD
7	7-Oct	9-Oct	Topics related to Module 3 - guest speaker TBD
8	14-Oct	16-Oct	Topics related to Module 4 - guest speaker TBD
9	21-Oct	23-Oct	Topics related to Module 4 - guest speaker TBD
10	28-Oct	30-Oct	Mid-point Review by IBM Executives
11	4-Nov	6-Nov	Meet in Groups - Instructor feedback
12	11-Nov	13-Nov	Groups Meet Outside of Class
13	18-Nov	20-Nov	Pre-Presentation to Selected Executives for input
14	25-Nov	27-Nov	Groups Meet Outside of Class
15	2-Dec	4-Dec	Meet in Groups - Instructors' feedback
16	9-Dec	11-Dec	Reading Week- Instructors will be available for feedback
		12-Dec	Final Presentations to Corporate at I-Lab

Grading: This is a Pass/No Pass Course - Students need to earn 900 points to pass. The grades will not be contingent on whether the Group wins the $100,000 or not.

Undergrads Innovate with Watson Supercomputer for Chance at $100,000

December 28, 2014

L-R: Vincent Tian, Jessie Salas,Vi Tran, Prof. Solomon Darwin, Andrew Koth, David Park, and David Fang.

The U.S. patent system has been called broken. But a team of undergrads at Berkeley-Haas believes a supercomputer named Watson could help fix it.

Team Patent Fox is heading to IBM Watson's new headquarters in New York City's Silicon Alley January 9 to test the mettle of a new patent application it developed in the *Open Innovation, Leveraging IBM Watson* course. The team will vie against nine other teams in the national competition for $100,000.

The winning team includes three business and three engineering majors: Vincent Tian, BS 16, Jessie Salas, BS 16, Vi Tran, BS 15, Andrew Koth, BS 15, David Park, BS 15, and David Fang, BS 16. Patent Fox beat three rival Berkeley-Haas teams Dec. 12 to get the chance to move forward in the IBM competition.

Watson is probably best known for beating the popular Jeopardy quiz show champs. By incorporating three key components—natural language processing, hypothesis generation/evaluation, and dynamic learning—Watson processes information in a way that is more like a human than a computer. It can process over 200 million records per second and learns over time as more information flows into it.

Open Innovation, Leveraging IBM Watson is taught by Solomon Darwin, executive director of the Garwood Center for Corporate Innovation. Berkeley-Haas is one of 10 universities and colleges across North America chosen to offer the course.

Patent Fox designed its app for businesses and law firms. The app relies on Watson's natural language processing abilities and contextual analysis to help organizations search for patent overlaps more quickly and thoroughly.

The team says the app will reduce the excessive cost and time typically associated with filing patent applications and ultimately help companies protect their patents. The average cost of filing a patent ranges between $1,200 to $6,000. Organizations spend $1.2 billion per year in the U.S. on so-called prior art searches required to prove a new patent's originality.

Patent Fox developed its plan with the help of a patent attorney and a patent examiner who were already working at a UC Berkeley patent startup, Park says. "We were connected to (the startup) and had a similar idea," he says. "They were using programmatic computing to solve a problem and we thought if we could use Watson the results would be even better. The way you train Watson is to train it to think and Watson becomes more human in that sense."

Y. Subramanyam, CEO of Apollo Hospitals, Asia's largest healthcare group, called the team's idea "just brilliant," considering the exponential rise in patent filings in Asia.

The runner-up Berkeley-Haas team, Health Note, developed an app that Apollo Hospitals could use to conduct better followup with patients after they leave the hospital. (Health Note will not move on to compete in New York).

The winning team January 9 will receive $50,000 from the IBM Watson Ecosystem group and $50,000 from The Entrepreneur's Fund, a technology venture firm. Students also receive continued access to IBM's Watson Developer Cloud and become part of the Watson Ecosystem partner program.

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2. SSMED
   (Service Science, Management, Engineering and Design)
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5. Cognitive Era
6. Service Systems Thinking

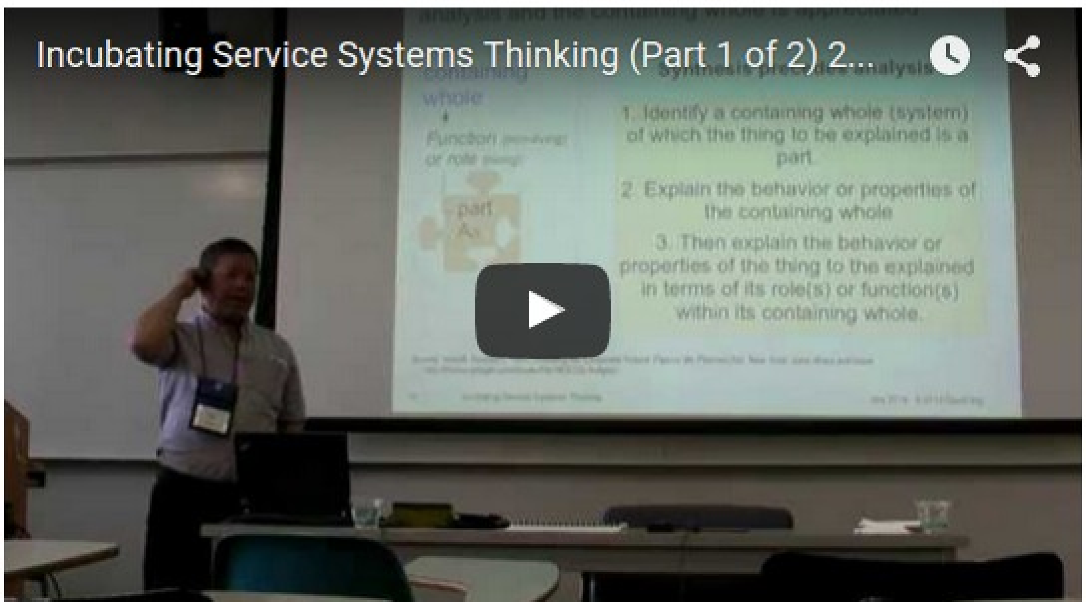
coevolving.com/blogs/index.php/archive/incubating-service-systems-thinking/

Incubating Service Systems Thinking

Posted on August 26, 2014 by daviding

Evolving the Proposal to Collaborate on a Pattern Language for Service Systems from January, the initiative has now taken on a label of *Service Systems Thinking*. The presentation at the 58th Annual Meeting of the International Society for the Systems Sciences in Washington DC was recorded, so that interested parties have the option of watching or listening ideas that have developed over the past six months, and reading the slides at their leisure. Here's the abstract:

> "Service systems thinking" is proffered as a label for an emerging body of work that: (i) builds on social systems thinking (i.e. socio-psychological, socio-technical and socio-ecological systems perspectives) to advance a transdisciplinary appreciation of service systems science, management, engineering and design; (ii) explores opportunities to enrich Alexanderian patterns and categorized pattern catalogs into a generative pattern language; and (iii) collaborates on new platforms, moving from inductive-consensual wiki pages to a multiple-perspectives (federated) wiki.



Part 1 Audio	[20140730_1453_ISSS_Ing_ServiceSystemsThinking_128Kbps.mp3] (85MB, 1h32m25s)		
Part 1 Video (1h32m26s)	nHD	qHD	HD

Categories

Categories

Select Category

Recent Posts

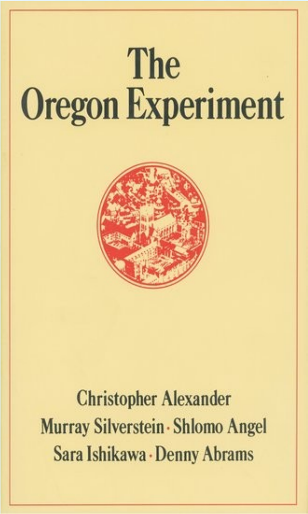
- Industrial Ecology in 2015
- Purplsoc 2015 digests and presentation
- Unfolding values in places, spaces and paces: Service systems thinking and architectural theory
- From Environmental Structure to Service Systems Thinking
- Much of the best work is done by amateurs (1890)
- Sustainable scale of an organization: A case study at IBM?
- Incubating Service Systems Thinking
- Scenarios and Design: Instigating Change, Methods Framing, Scenario-Buffered Design
- Systems generating systems — architectural design theory by Christopher Alexander (1968)
- Mediating spaces, rich research spaces and GIGA-mapping

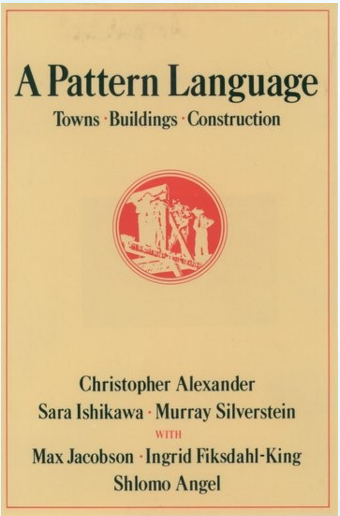
Recent Comments

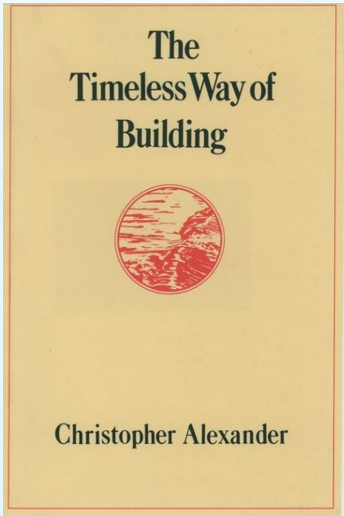
ea-builder.net on Sustainable scale of an organization: A case study at IBM?

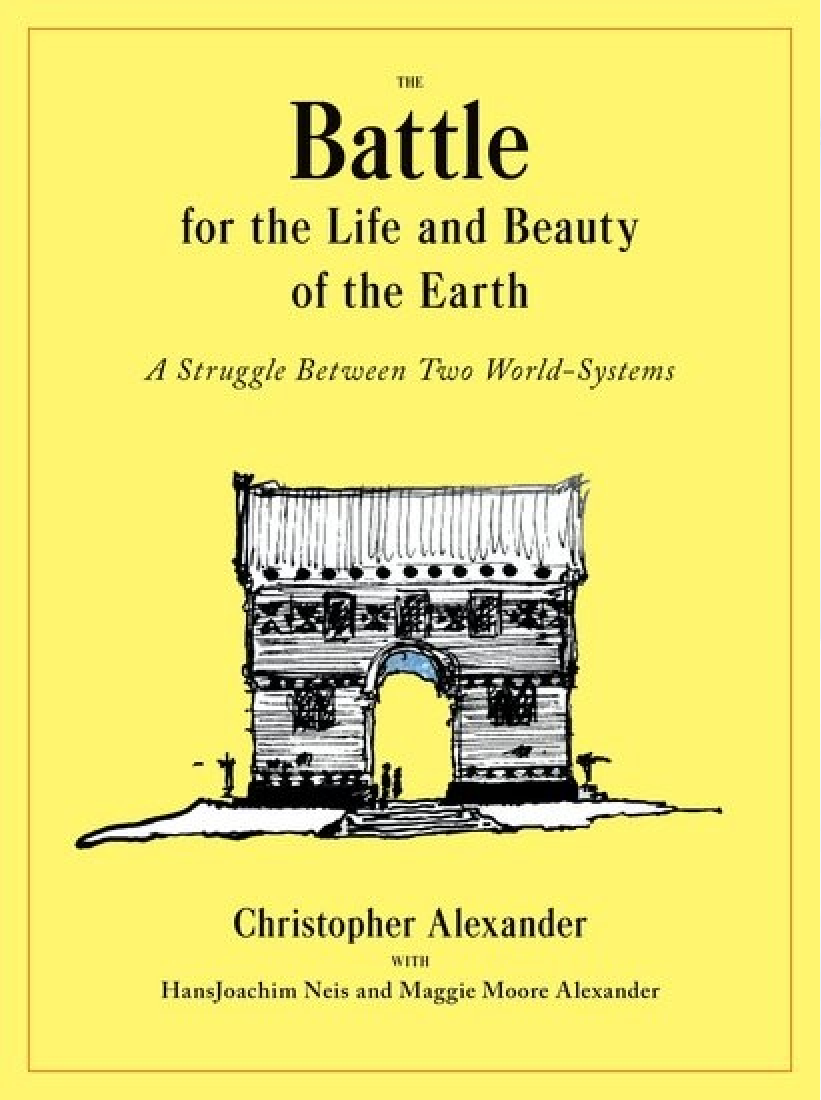
Thomas Wallace on

The writing of 1975-1979 by Alexander was prescriptive; the 2012 is reflections on practice

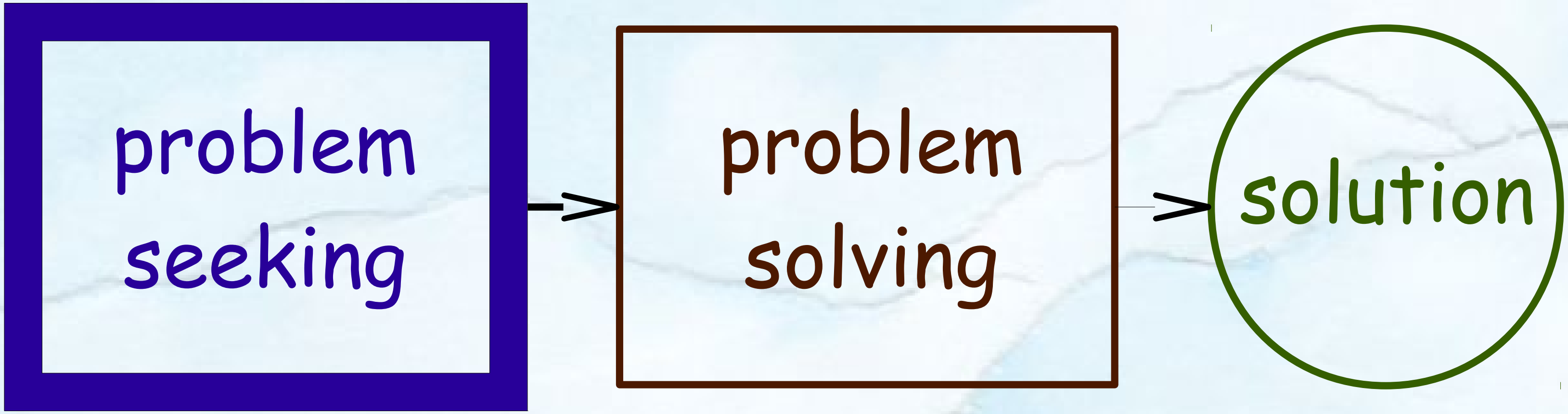








Pattern language presumes *problem seeking* as *architectural programming*, and *problem solving* as *design*



Programming is a specialized and often misunderstood term. It is "*a statement of an architectural problem* and the requirements to be met in offering a solution. While the term is used with other descriptive adjectives such as *computer* programming, *educational* programming, *functional* programming, etc., in this report, programming is used to refer only to architectural programming.

Why programming? The client has a project with many unidentified sub-problems. The architect must define the client's total problem.

Design is problem solving; programming is problem seeking. The end of the programming process is a statement of the total problem; such a statement is the element that joins programming and design. The "total problem" then serves to point up constituent problems, in terms of four considerations, those of form, function, economy and time. The aim of the programming is to provide a sound basis for effective design. The State of the Problem represents the essense and the uniqueness of the project. Furthermore, it suggests the solution to the problem by defining the main issues and giving direction to the designer (Pena and Focke 1969, 3).

Mainstream architecture and urban design are rationalistic and teleological; Alexander is ateleological

Attributes of the design process	Development philosophies	
	Teleological development	Ateleological development
Ultimate purpose	Goal / purpose	Wholeness / harmony
Intermediate goals	Effectiveness / efficiency	Equilibrium / homeostasis
Design focus	Ends / result	Means / process
Designers	Explicit designer	Member / part
Design scope	Part	Whole
Design process	Creative problem solving	Local adaptation, reflection and learning
Design problems	Complexity and conflict	Time
Design management	Centralized	Decentralized
Design control	Direct intervention with a master plan	Indirect via rules and regulations

Lucas D. Introna 1996. “Notes on Ateleological Information Systems Development.” *Information Technology & People* 9 (4): 20–39. doi:10.1108/09593849610153412.

Here is a short and necessarily incomplete definition of a pattern:

A recurring structural configuration that solves a problem in a context, contributing to the wholeness of some whole, or system, that reflects some aesthetic or cultural value.[1]

Pattern Name: A name by which this problem/solution pairing can be referenced

Problem
The specific problem that needs to be solved.

Context
The circumstances in which the problem is being solved imposes constraints on the solution. The context is often described via a "situation" rather than stated explicitly.

Forces
The often contradictory considerations that must be taken into account when choosing a solution to a problem.

Solution
The most appropriate solution to a problem is the one that best resolves the highest priority forces as determined by the particular context.

Resulting Context
The context that we find ourselves in after the pattern has been applied. It can include one or more new problems to solve

Rationale
An explanation of why this solution is most appropriate for the stated problem within this context.

Related Patterns
The kinds of patterns include:

- Other solutions to the same problem,
- More general or (possibly domain) specific variations of the pattern,
- Patterns that solve some of the problems in the resulting context (set up by this pattern)

Source: [1] Coplien, James O., and Neil B. Harrison. 2004. Organizational Patterns of Agile Software Development. Prentice-Hall, Inc. http://books.google.ca/books?id=6K5QAAAAMAAJ . [2] Gerard Meszaros and Jim Doble, "A Pattern Language for Pattern Writing", Pattern Languages of Program Design (1997), http://hillside.net/index.php/a-pattern-language-for-pattern-writing

127 INTIMACY GRADIENT**

. . . if you know roughly where you intend to place the building wings -- WINGS OF LIGHT (107), and how many stories they will have -- NUMBER OF STORIES (96), and where the MAIN ENTRANCE (110) is, it is time to work out the rough disposition of the major areas on every floor. In every building the relationship between the public areas and private areas is most important.

* * *

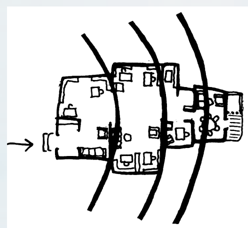
Unless the spaces in a building are arranged in a sequence which corresponds to their degrees of privateness, the visits made by strangers, friends, guests, clients, family, will always be a little awkward.

In any building -- house, office, public building, summer cottage - people need a gradient of settings, which have different degrees of intimacy. A bedroom or boudoir is most intimate; a back sitting room. or study less so; a common area or kitchen more public still; a front porch or entrance room most public of all. When there is a gradient of this kind, people can give each encounter different shades of meaning, by choosing its position on the gradient very carefully. In a building which has its rooms so interlaced that there is no clearly defined gradient of intimacy, it is not possible to choose the spot for any particular encounter so carefully; and it is therefore impossible to give the encounter this dimension of added meaning by the choice of space. This homogeneity of space, where every room has a similar degree of intimacy, rubs out all possible subtlety of social interaction in the building.

We illustrate this general fact by giving an example from Peru - a case which we have studied in detail. [....]

The intimacy gradient is unusually crucial in a Peruvian house. But in some form the pattern seems to exist in almost all cultures. We see it in widely different cultures -- compare the plan of an African compound, a traditional Japanese house, and early American colonial homes -- and it also applies to almost every building type -- compare a house, a small shop, a large office building, and even a church. It is almost an archetypal ordering principle for all man's buildings. All buildings, and all parts of buildings which house well defined human groups, need a definite gradient from "front" to "back," from the most formal spaces at the front to the most intimate spaces at the back.

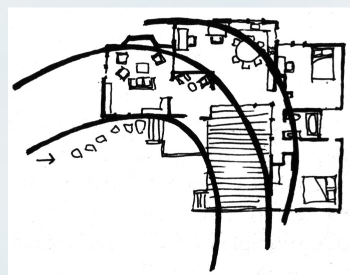
In an office the sequence might be: entry lobby, coffee and reception areas, offices and workspaces, private lounge.



Office intimacy gradient.

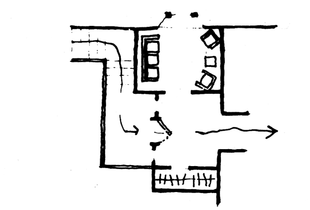
In a small shop the sequence might be: shop entrance, customer milling space, browsing area, sales counter, behind the counter, private place for workers.

In a house: gate, outdoor porch, entrance, sitting wall, common space and kitchen, private garden, bed alcoves.



Intimacy gradient in a house.

And in a more formal house, the sequence might begin with something like the Peruvian sala -- a parlor or sitting room for guests.



Formal version of the front of the gradient.

Source: Christopher Alexander et. al. 1997, *A Pattern Language: Towns, Building, Construction*, Oxford Press.-

127 INTIMACY GRADIENT**

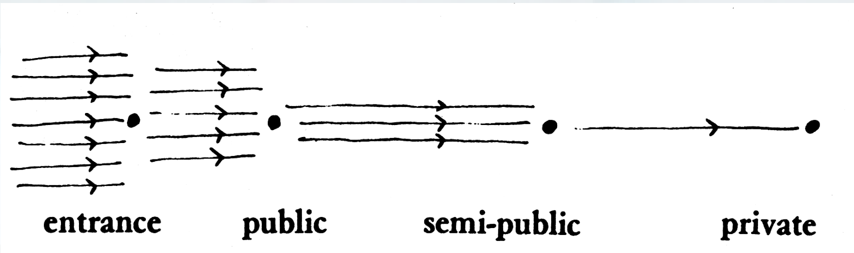
. . . if you know roughly where you intend to place the building wings -- WINGS OF LIGHT (107), and how many stories they will have -- NUMBER OF STORIES (96), and where the MAIN ENTRANCE (110) is, it is time to work out the rough disposition of the major areas on every floor. In every building the relationship between the public areas and private areas is most important.

* * *

Unless the spaces in a building are arranged in a sequence which corresponds to their degrees of privateness, the visits made by strangers, friends, guests, clients, family, will always be a little awkward.

Therefore:

Lay out the spaces of a building so that they create a sequence which begins with the entrance and the most public parts of the building, then leads into the slightly more private areas, and finally to the most private domains.



* * *

At the same time that common areas are to the front, make sure that they are also at the heart and soul of the activity, and that all paths between more private rooms pass tangent to the common ones -- COMMON AREAS AT THE HEART (129). In private houses make the ENTRANCE ROOM (130) the most formal and public place and arrange the most private areas so that each person has a room of his own, where he can retire to be alone A ROOM OF ONE'S OWN (141). Place bathing rooms and toilets half-way between the common areas and the private ones, so that people can reach them comfortably from both BATHING ROOM (144); and place sitting areas at all the different degrees of intimacy, and shape them according to their position in the gradient - SEQUENCE OF SITTING SPACES (142). In offices put RECEPTION WELCOMES YOU (149) at the front of the gradient and HALF-PRIVATE OFFICE (152) at the back. . . .

Source: Christopher Alexander et. al. 1997, *A Pattern Language: Towns, Building, Construction*, Oxford Press.-

127 INTIMACY GRADIENT**

www.jacana.plus.com/pattern/P127.htm

INTIMACY GRADIENT ** 127

Buildings: Gradients of space and movement Menu Prev Next

Problem

Unless the spaces in a building are arranged in a sequence which corresponds to their degrees of privateness, the visits made by strangers, friends, guests, clients, family, will always be a little awkward.

Solution

Lay out the spaces of a building so that they create a sequence which begins with the entrance and the most public parts of the building, then leads into the slightly more private areas, and finally to the most private domains.

Select High Order Pattern and Go **to it.**

- 96 NUMBER OF STORIES *
- 107 WINGS OF LIGHT **
- 110 MAIN ENTRANCE **

Select Low Order Pattern and Go **to it.**

- 129 COMMON AREAS AT THE HEART **
- 130 ENTRANCE ROOM **
- 141 A ROOM OF ONE'S OWN **
- 142 SEQUENCE OF SITTING SPACES *

Source: Christopher Alexander et. al. 1997, *A Pattern Language: Towns, Building, Construction*, Oxford Press.-

www.lifewithalacrity.com/2004/08/intimacy_gradie.html

August 26, 2004

Intimacy Gradient and Other Lessons from Architecture

A number of my posts have been about integrating different domai
understand how human behavior should be incorporated in the de
Dunbar Number in sociology, and both Four Kinds of Privacy and F
work in the cryptography field. The topic of this post comes from th

In order to provide for Progressive Trust, you need to establish wh
Gradient".

The concept of Intimacy Gradient comes from architect Christophe
Language: Towns, Buildings, Construction. (Oxford University Pres

> *Pattern #127 - Intimacy Gradient:*
>
> **Conflict:** *Unless the spaces in a building are arranged in corresponds to their degrees of privateness, the visits ma guests, clients, family, will always be a little awkward.*
>
> **Resolution:** *Lay out the spaces of a building so that they begins with the entrance and the most public parts of the slightly more private areas, and finally to the most private*

In architecture there are always some areas of the house or buildir
entry, the living room, the atrium, etc., and areas that are more pri
bedrooms, and offices. In a good design there is some marker of c
areas -- it might be a difference in ceiling height, a stairway leading
entrance. As an example, in the classical Japanese tea house, you

Failure to respect the Intimacy Gradient results in uncomfortable b
about a Frank Gehry building at Case Western Reserve University:

> *I asked many of the graduate students how they felt abou "Horrible," said one. "Like living in a refrigerator" said ano comfortable offices and gathering places, and had the mo Now everything is so sterile, and the acoustics so bad, tha together. I have to go outside if I want any privacy."*

The Intimacy Gradient is also used in other media. As I noted in my
Hand Circus:

When we arrived, we were led down the side of the theatr noticed that it looked like we were all being led backstage a sudden see an entrance -- maybe 5 foot tall requiring m through and to our surprise, we are have walked through

The Intimacy Gradient is also used in other media. As I noted in my review of Seven Fingers of the Hand Circus:

> *When we arrived, we were led down the side of the theatre and all of a sudden I noticed that it looked like we were all being led backstage. We curve around and all of a sudden see an entrance -- maybe 5 foot tall requiring most of us to duck. We duck through and to our surprise, we are have walked through a fridgerator, and we are on the stage!*
>
> *One of the 7 players welcomes us, and another offers random people a glass of tea as we walk across the stage to our seats. The stage is set like a city loft, with a tv, some couches, a bed, a bathtub and shower, a kitchen, and of course the fridgerator we entered through. On the stage, and chatting to members of the audience are the 7 cast members, all wearing comfortable looking white shorts or athletic and white t-shirts.*
>
> *The audience arrives over 30 minutes and the 7 players act as if we are guests of their loft, serving some of us tea, chatting, sweeping the floor, etc.*

Entering through the refrigerator door raised the intimacy of the experience for the audience of that circus. Thus in spite of it being produced in a large auditorium it felt as up-close and personal as did the much smaller Circus Contraption.

The Intimacy Gradient exists in movies as well -- anywhere you see a scene taking place in a public space that transitions down through smaller and tighter shots ultimately to a closeup of a face it is much more intimate then just cutting to the closeup.

In social software design, there also needs to be an Intimacy Gradient. One of the problems with Wikis is that there is often very little transition between public and intimate, and doing so can be quite jarring. SocialText, a Wiki service vendor, is aware of this problem and is "seeking to add more layers to the 'intimacy gradient', without recreating the highly structured collaboration tools that exist today". Ross Mayfield outlines this possible future Intimacy Gradient for SocialText:

- *The broadest tier is a guest space, available to all*
- *The second tier is a knowledgebase, accessible to all employees and contractors*
- *The third tier is product development, for employees and contractors bound by a confidentiality agreement*
- *The fourth tier is for the core management team to share confidential financial and HR information.*

Can we make better service systems, learning inductively from architecting built environments?

Deduction == (1) rule, (2) case, (3) result;
Induction == (1) case, (2) result, (3) rule;
Abduction == (1) result, (2) rule, (3) case.
From Charles S. Peirce via Barbara Minto. 1976.
The Pyramid Principle: Logic in Writing and Thinking.

(3) Rule:
A service system can be enjoyed by a variety of parties with value(s) unfolding over time

(2) Result:
Engaging with service systems can be reframed as experiences in places, spaces and paces

(1) Case:
Approaching the Eishin campus as a service system appreciates the practices of Christopher Alexander in creating a pattern language and combining systems of centers.

An *unfolding* is a process which gets you from one stage or moment of development to the next moment of development, in the evolution of a neighborhood or in the evolution of a building

1. An unfolding is a dynamic configuration that acts to generate form.
2. An unfolding arises from the particular whole in which it is forming. It is shaped by the whole, and acts upon the whole, and causes the rebirth of the whole.
3. An unfolding is by its nature personal, and requires human input and human feeling from the people doing the work, as an essential part of its contribution to the formation of the environment.

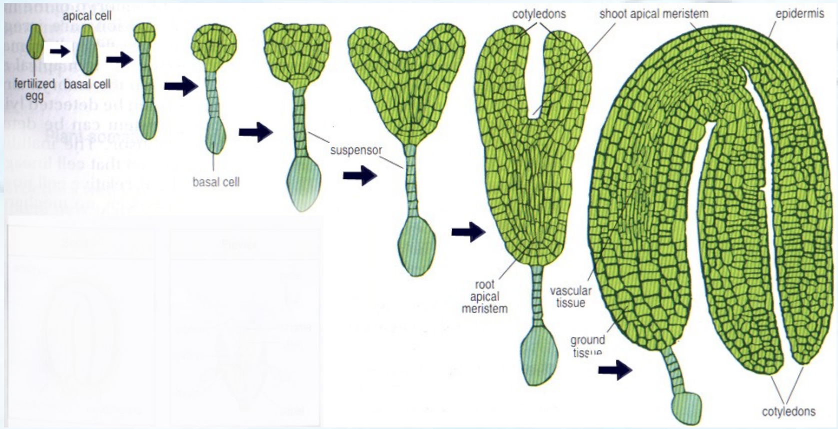
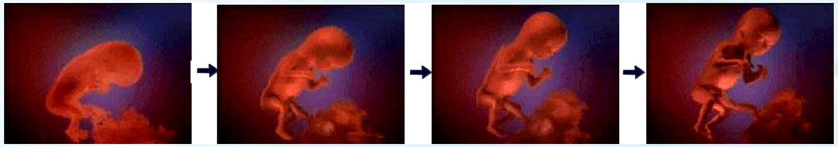
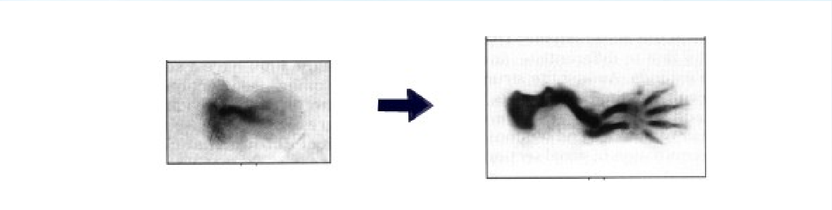


Diagram of a typical angiosperm (flowering plant) unfolding



Photographs of a human embryo unfolding



Two photographs, three days apart, of a mouse foot unfolding

It is helpful to compare such unfoldings with similar phenomena in plant morphogenesis and embryology. Both in the angiosperm shown below, and in the embryo shown beneath it, you can picture each unfolding as a limited and brief process which in the first one gradually shapes the seed, and in the second, takes the blur that is the beginning of a hand in the embryo, to the next stage of development where the hand gets its first outline fingers.

Adapted from Christopher Alexander, "What is an unfolding?" at http://www.livingneighborhoods.org/ht-0/whatisanunfolding.htm

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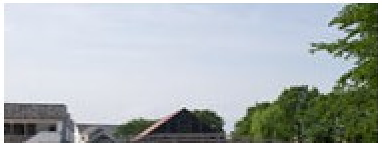
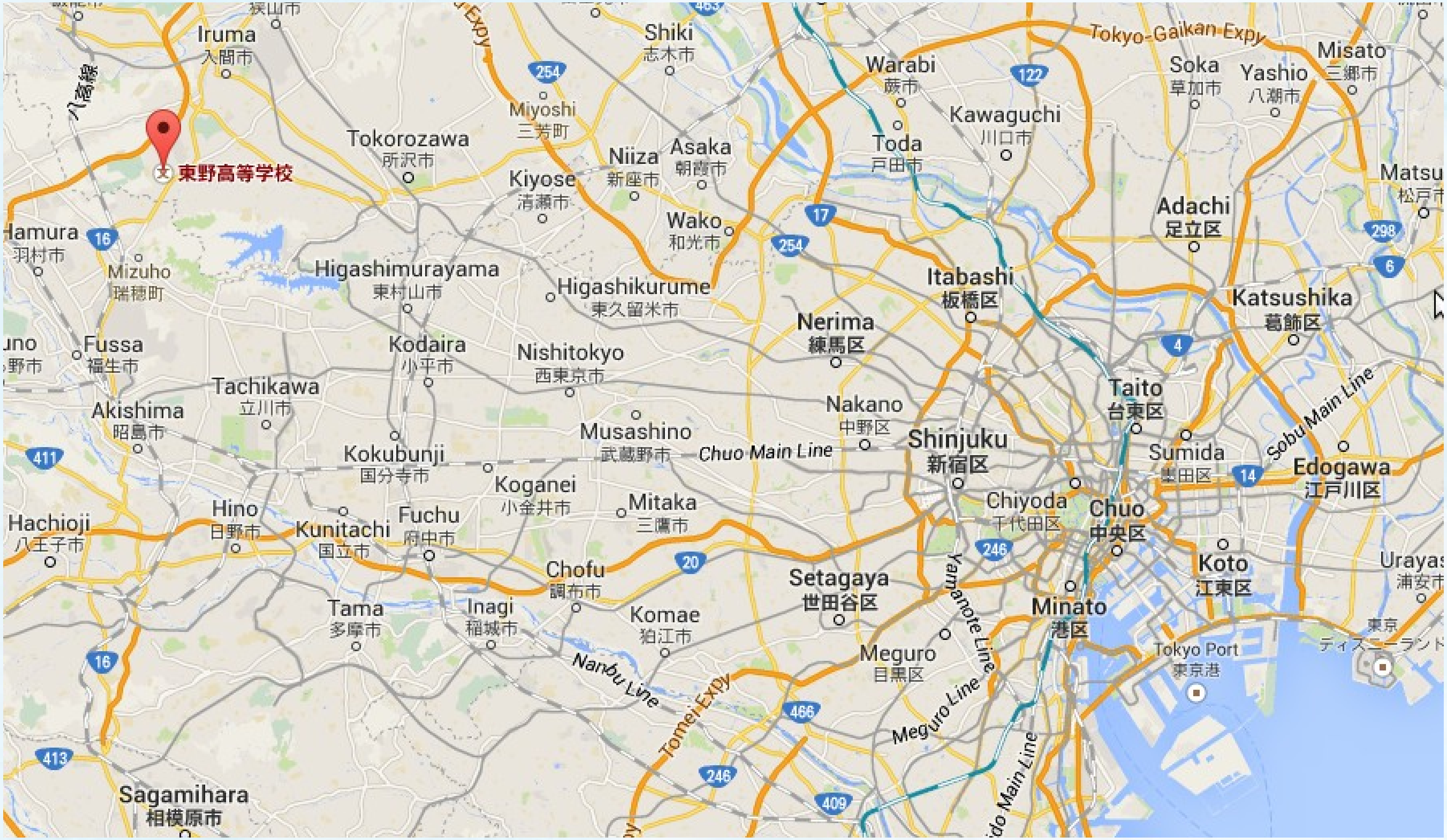
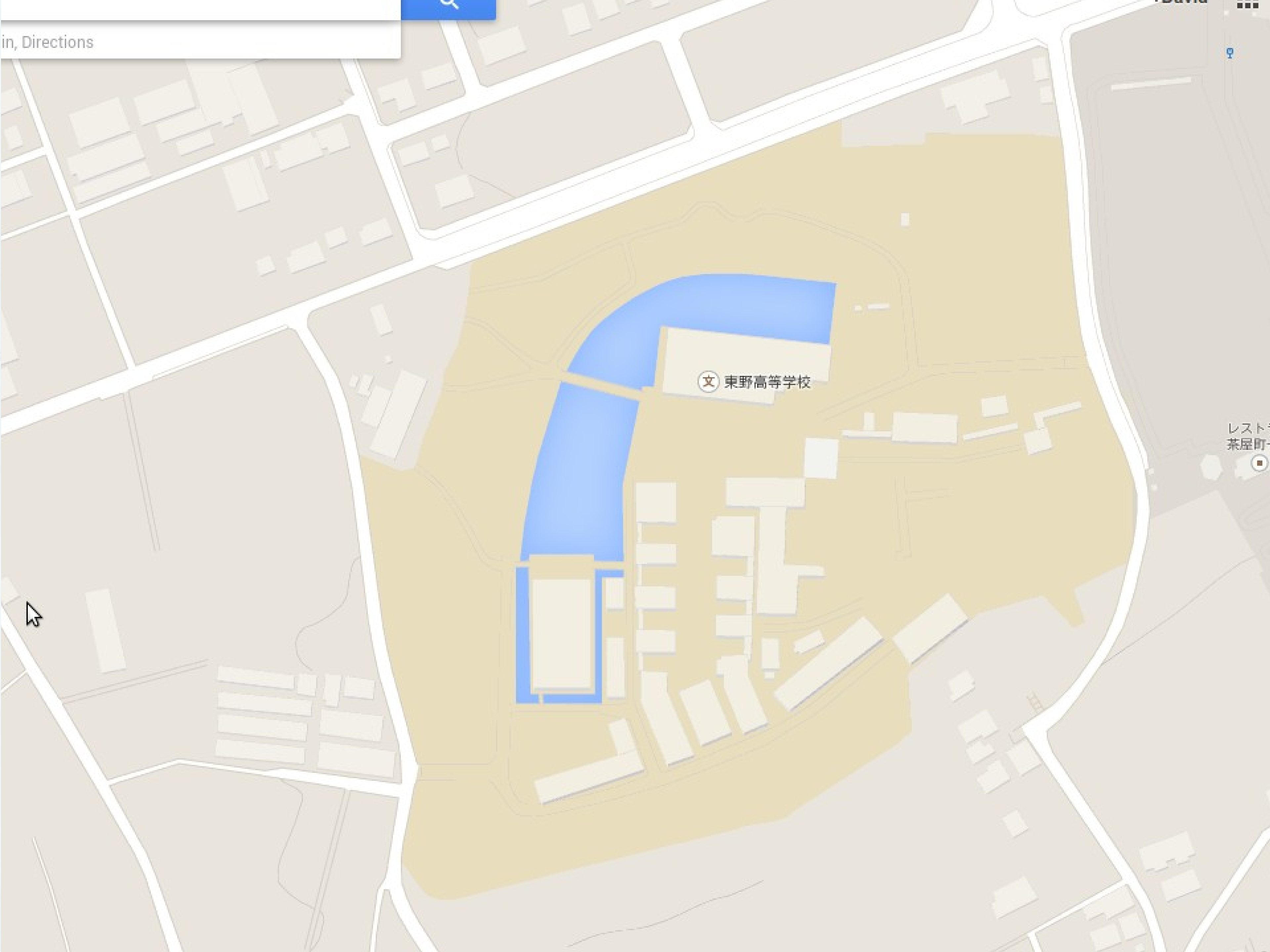
twitter 犬猿の仲印パからノーベル平和賞受賞者。17歳のマララさんについて「テロリストが最も恐れるのは『教科書を持った少女』だ」と潘基文氏。＜ペンは剣より強し＞



The site originally was tea fields in Iruma, Saitama prefecture, northwest of Tokyo

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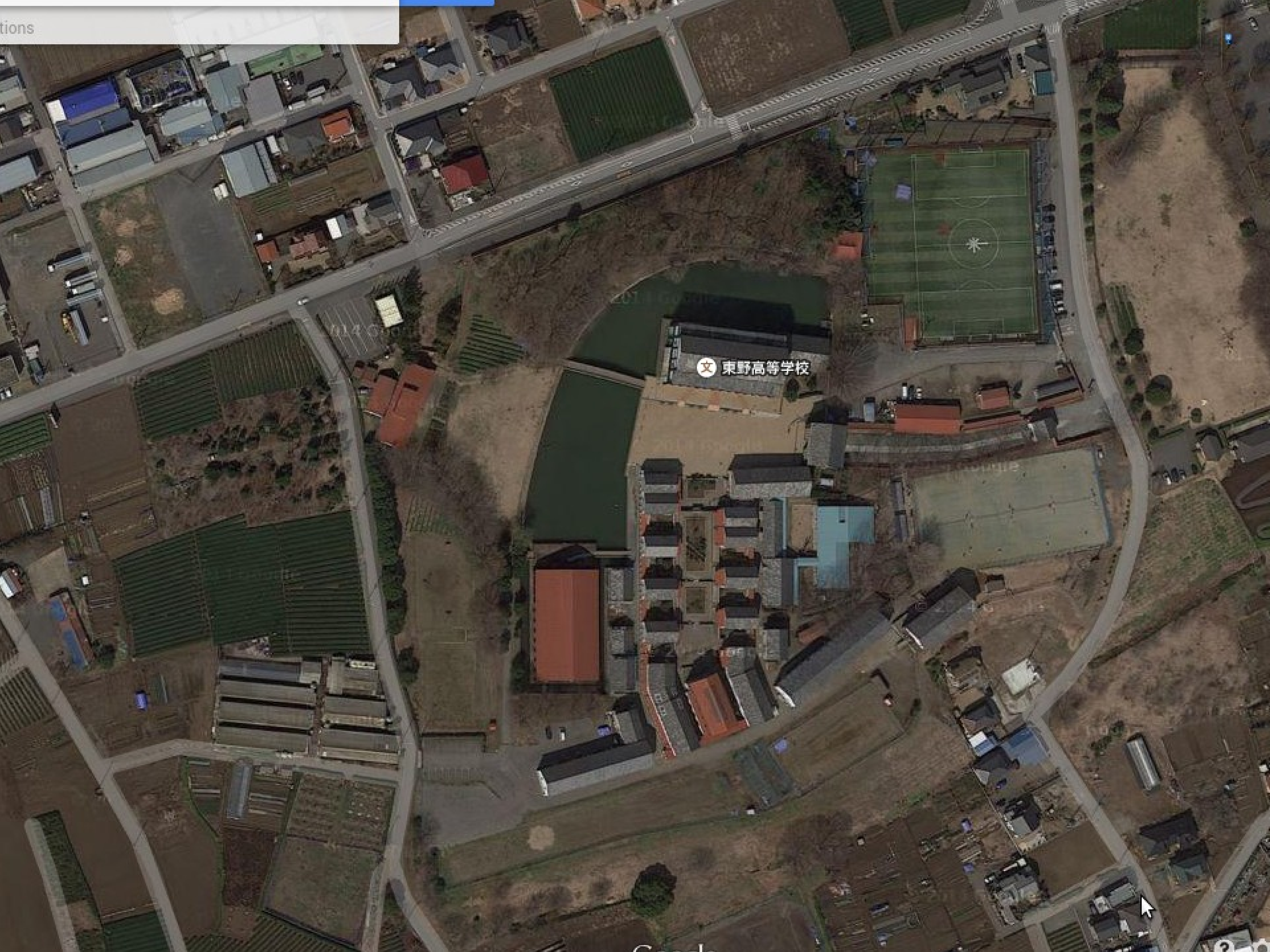

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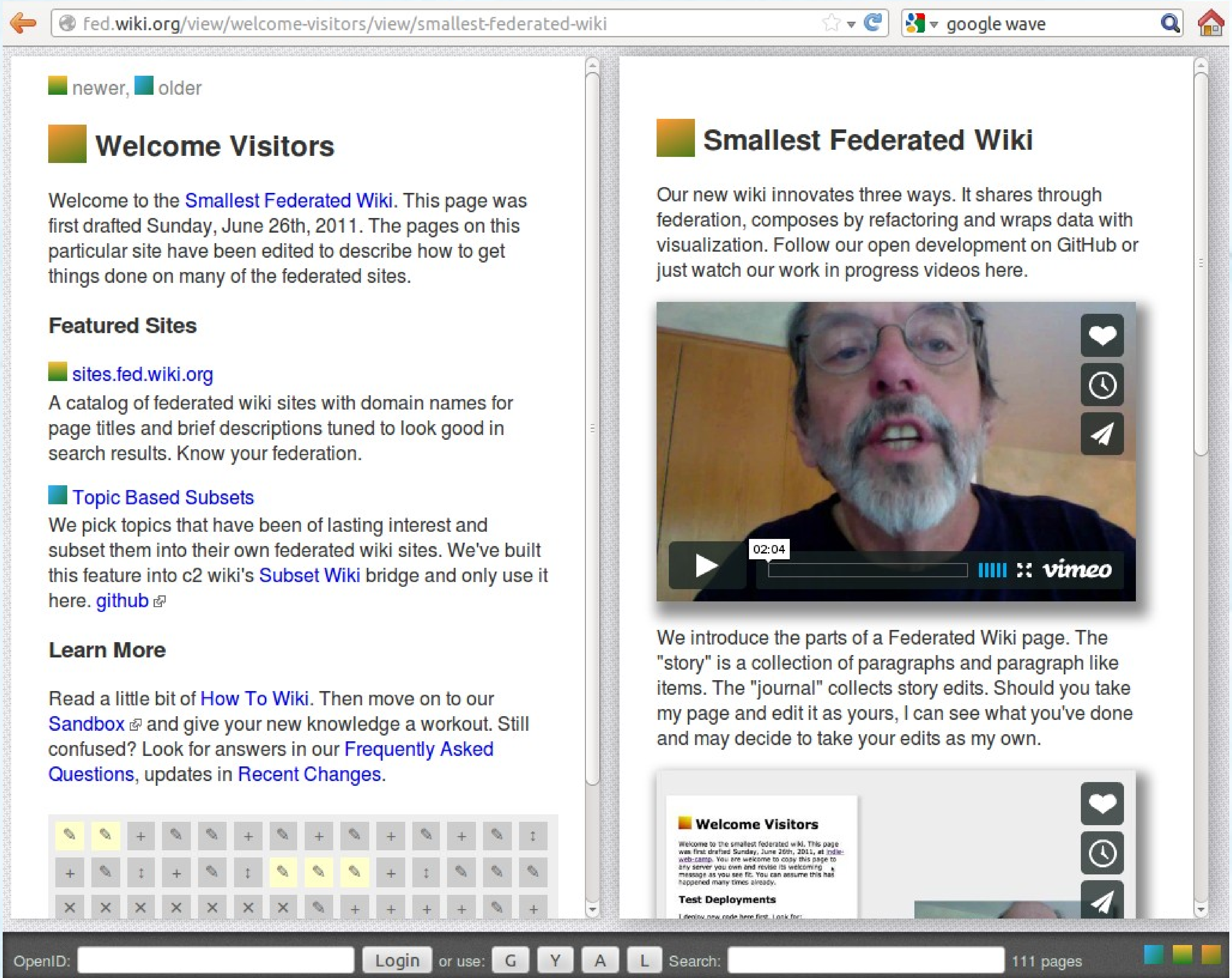
The practices employed on the 1985 Eishin project can be traced with 8 activities

1. Interview on hopes and dreams
2. Make a “poetic vision” as first sketch of a pattern language
3. Make the rudimentary pattern language physically coherent
4. Refine the language through discussions
5. Obtain approval of the pattern language
6. Renegotiate pattern language with space and money within budget
7. Find systems of centers in (i) the notions in people's minds, and (ii) the places in the land. Combine them.
8. Adjust the site plan on the site itself (not on models)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Welcome to the Smallest Federated Wiki. This page was first drafted Sunday, June 26th, 2011. The pages on this particular site have been edited to describe how to get things done on many of the federated sites.
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A catalog of federated wiki sites with domain names for page titles and brief descriptions tuned to look good in search results. Know your federation.
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We pick topics that have been of lasting interest and subset them into their own federated wiki sites. We've built this feature into c2 wiki's Subset Wiki bridge and only use it here. github
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Conversations for Orientation on Service Systems Thinking

Service systems thinking builds on the foundations of a variety of fields. An appreciation of parts of those fields can serve as a common understanding to be cross-appropriated for further development of a body of knowledge.

1. Systems Thinking
2. Service Science, Management, Engineering and Design
3. Generative Pattern Language
4. Multiple Perspectives Open Collaboration

Generative Pattern Language

While the label "pattern language" has been appropriated for a variety of contexts, the label of "generative pattern language" can be used for the "purer" thinking originating from the Center for Environmental Structure at U.C. Berkeley.

Christopher Alexander and his colleagues have a significant body of artifacts since the formation of the CES in 1967.

Pattern Manual (1967) is a charter for the CES.

A Pattern Language Which Generates Multi-Service Centers (1968) demonstrates how a pattern language could become instantiated differently for a variety of sites and circumstances.

"Systems Generating Systems (1968)" articulates the ties between a pattern language and systems thinking.

The Battle for Life and Beauty of the Earth (2012) is a history of a development project for the Eishin campus in Japan, demonstrating the CES vision from start to finish.

The variety of Current Applications of Pattern Languages often don't reflect the full vision of generativity.

Seeking concurrence

- International Workshop, Jan 2014, Los Angeles
- International Symposium, June 2014, Las Vegas
- Human Side of Service Engineering, July 2014, Krakow
- ISSS 58th Annual Meeting, July 2014, Washington, DC
- Pattern Languages of Programming Conference, September 2014, Allerton, IL
- Relating Systems Thinking and Design Symposium, October 2014, Oslo
- PURPLSOC Pursuit of Pattern Languages for Societal Change Conference, July 2015, Krems

Agenda

1. Systems Sciences
2. SSMED
   (Service Science, Management, Engineering and Design)
3. Service Systems Science
4. Smarter Planet, Smarter Cities
5. Cognitive Era
6. Service Systems Thinking

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David Ing OWNER
Discussion - 15 Sep 2015

Don Norman @jnd1er with **+Pieter Jan Stappers** at **#RSD4** video on: What characteristics make a DesignX problem (or a complex socio-technical problem)? The list started as 3, became 8 by August, and then 9 after the dinner (in September):

Read more (41 lines)

Don Norman Keynote at Relating Systems Thinking an...

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About this community

David Ing OWNER
Discussion - 19 Sep 2015

Fashion Thinking, writes @natwnixon is "a lens a
using technology, story, experimentation and op
meaning and value to the functional and experie
products and services".

Read more (23 lines)

5 Ways to Innovate With the Power of F

Inc.

This Fashion Thinking framework will unleash all kin
anticipate the new and remix the old.

+1

4 comments