



Service Systems Thinking: Reflecting on acts of representation

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the International Society for the Systems Sciences

Understanding Systems & Systemic Design
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Agenda

1. Architecting ↔ designing

2. Service systems ← production systems

3. Affordances ↔ pattern language

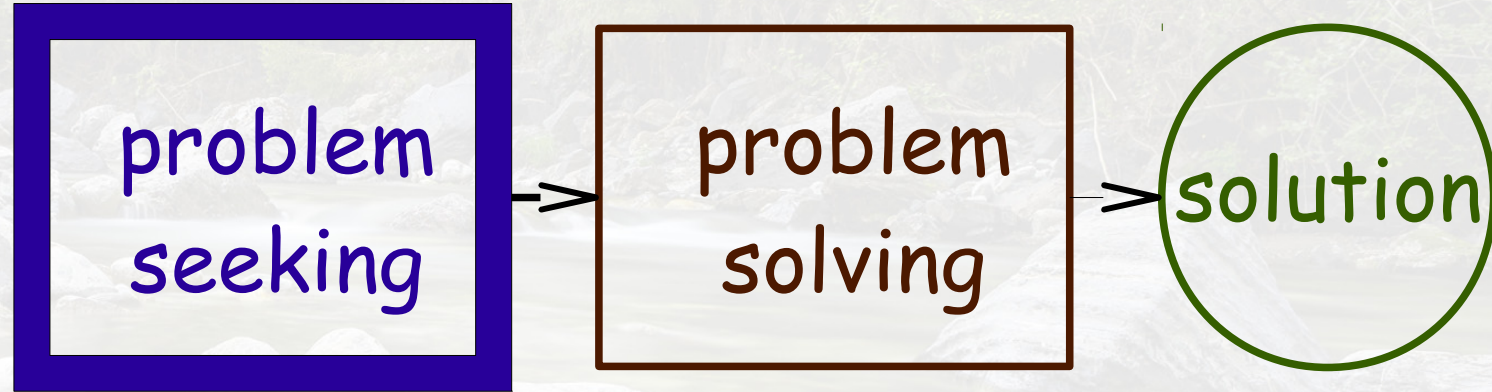
4. Ecological anthropology ← teleology

5. Inquiring systems ↔ methods

In 1969, problem seeking was *architectural programming*, and problem solving was *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 essence 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).

All architecture is design, but not all design is architecture

Architectural thinking as
shaping the structure of the environment ...

Living systems are *autopoietic*,
self-organizing and self-generating;

assembly lines are *allopoietic*,
externally-organizing and externally-generating.

Design thinking as
divergent steps (i.e. creating choices) and
convergent steps (i.e. making choices)

Pacing layers emphasize coevolution and learning

SITE

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

STRUCTURE

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

SKIN

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

SERVICES

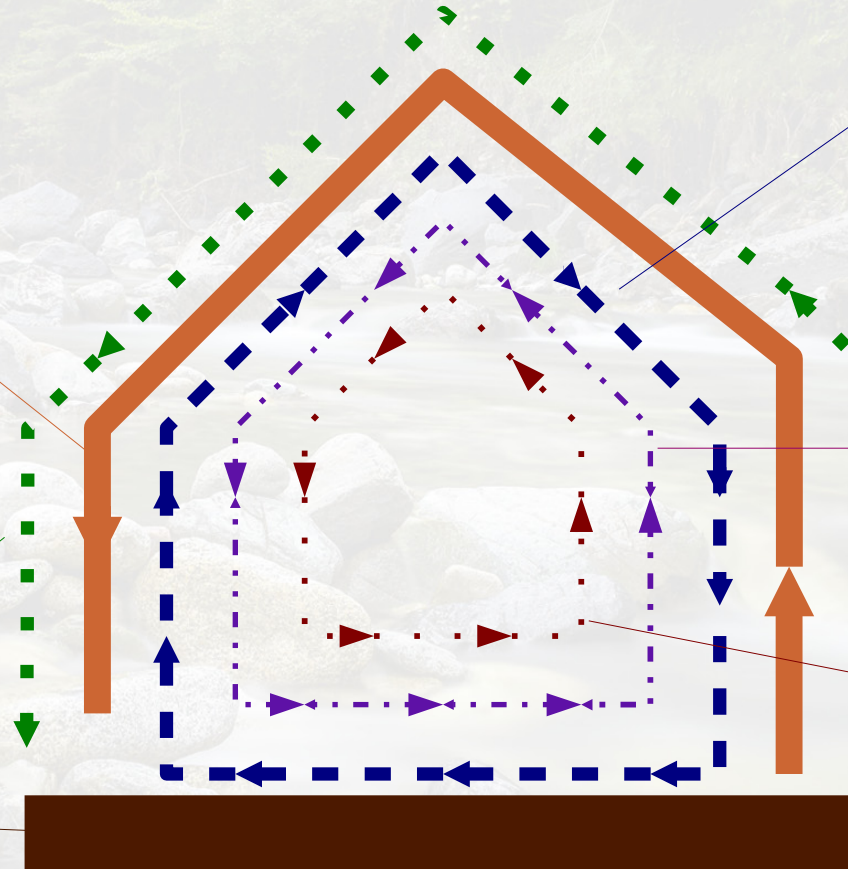
These are the working guts of a building: communications wiring, electrical wiring, plumbing, sprinkler system, HVAC (heating, ventilation, and air conditioning), and moving parts like elevators and escalators. They wear out or obsolesce every 7 to 15 years. Many buildings are demolished early if their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

SPACE PLAN

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

STUFF

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



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

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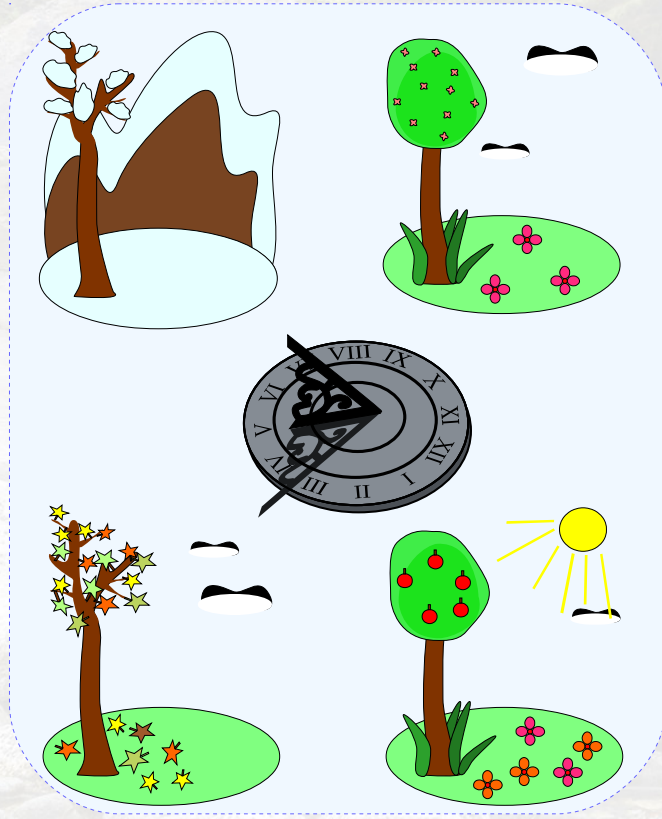
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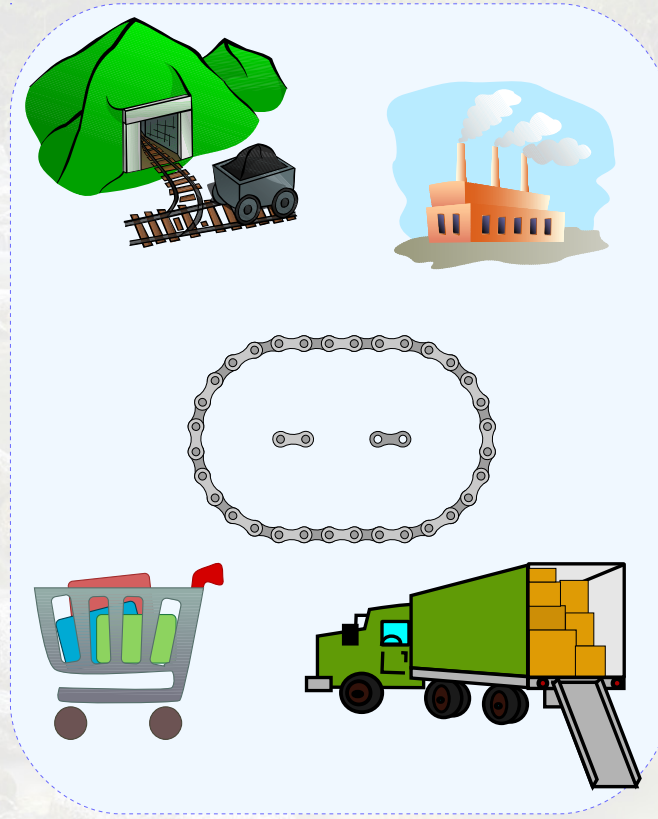
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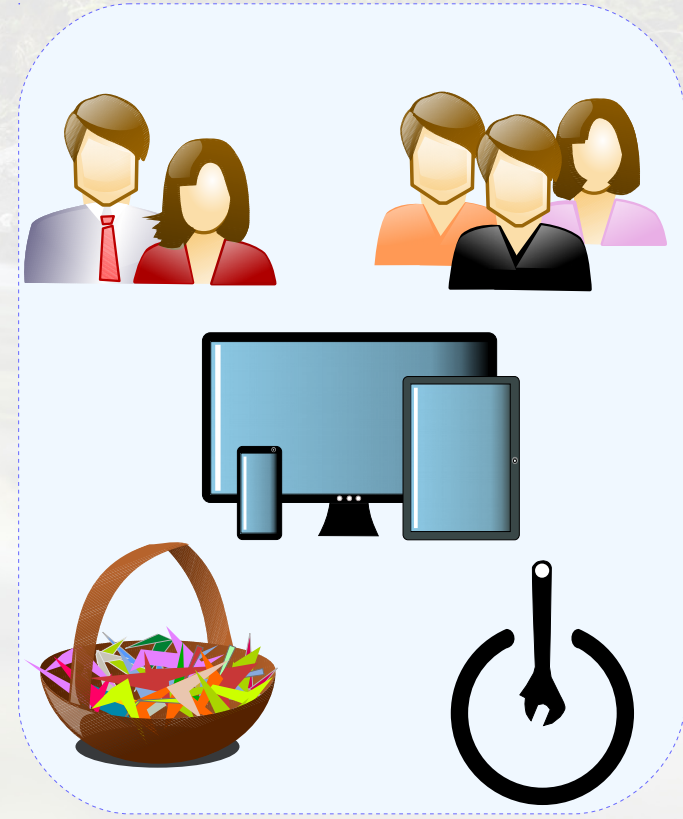
Is thinking different across agricultural systems, industrial systems, and service systems?



Agricultural Systems



Industrial Systems



Service Systems(?)

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

Systems that
move, store,
harvest,
process

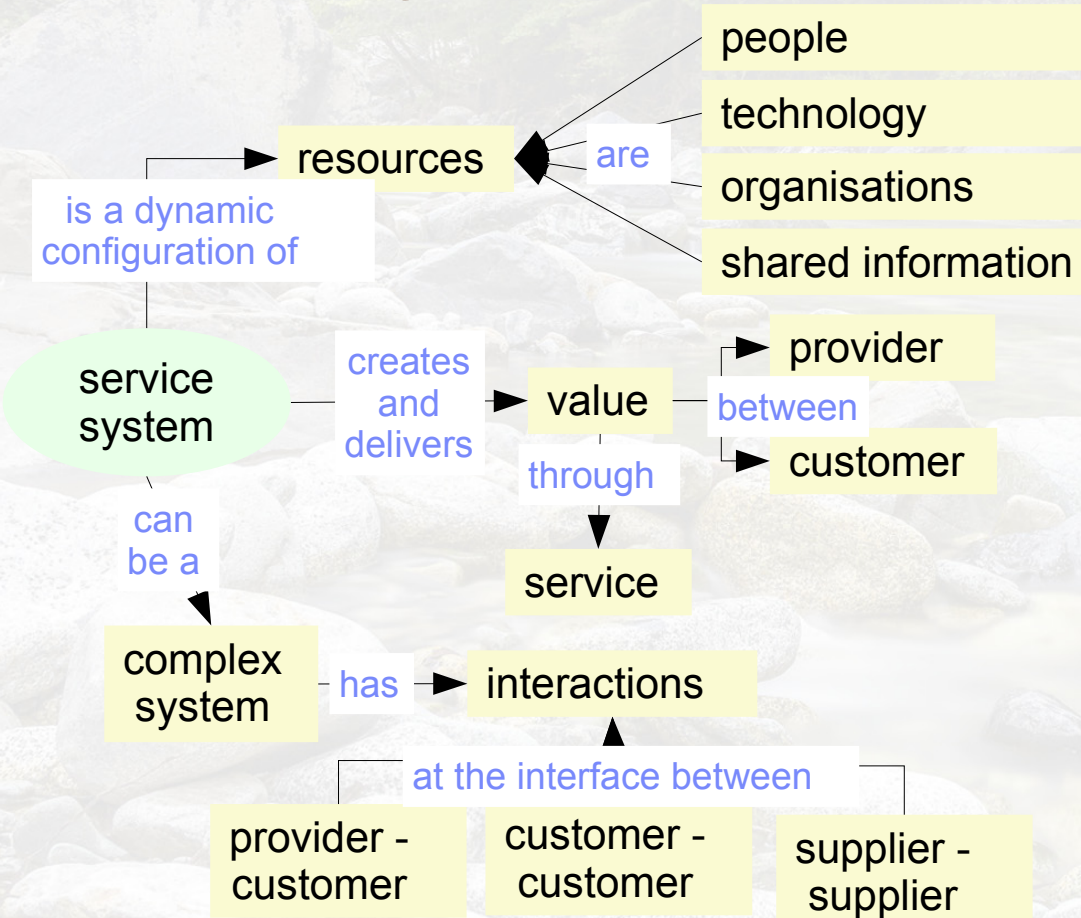
• Transportation	K
• Water and waste management	1
• Food and global supply chain	2
• Energy and energy grid	3
• Information + communications (ICT) infrastructure	4
• Building and construction	5
• Banking and finance	6
• Retail and hospitality	7
• Healthcare	8
• Education (including universities)	9
• Government (cities)	10
• Government (regions / states)	11
• Government (nations)	12

Systems that
enable healthy,
wealthy and
wise people

Systems that
govern

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

After 2007, service systems have been recognized as the largest part of developed economies globally



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.

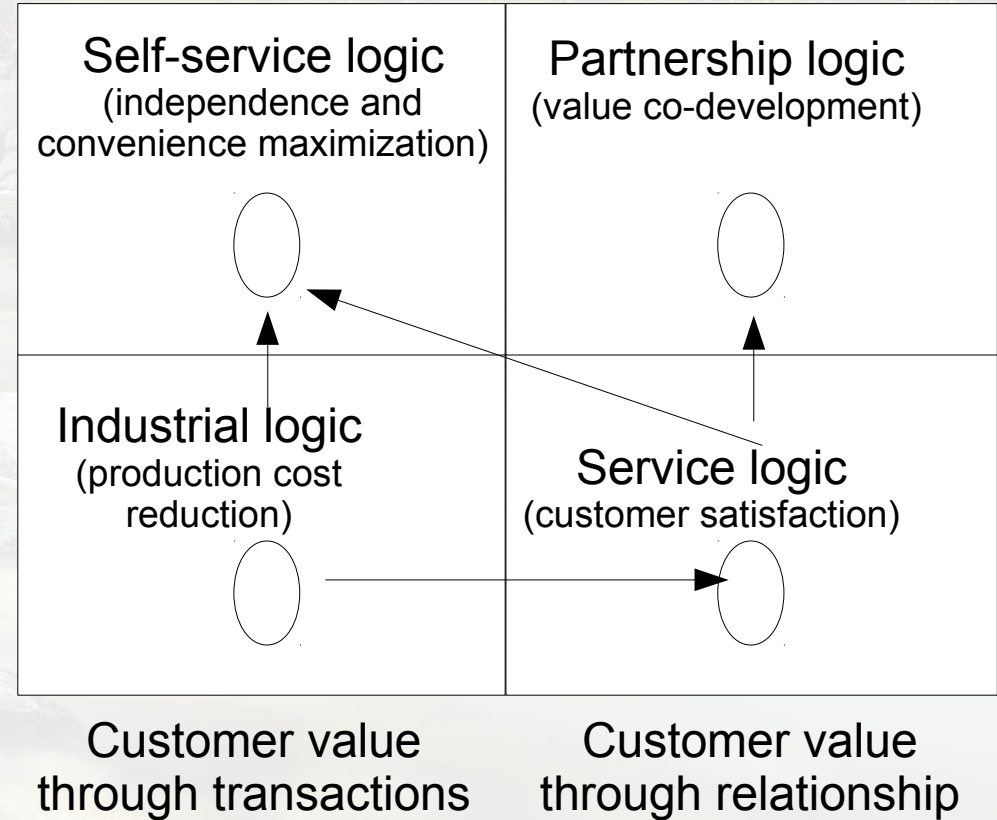
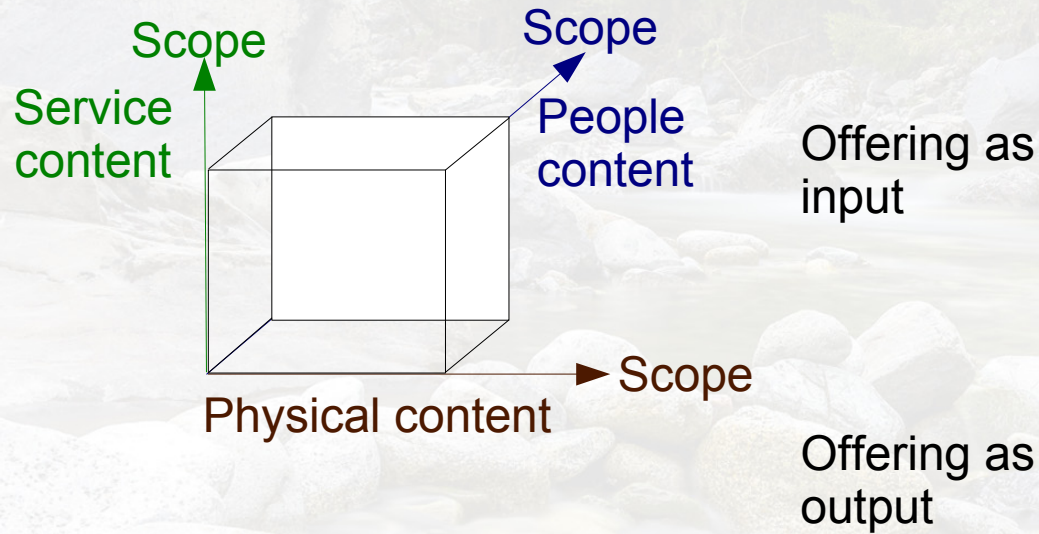
In many cases, a service system is a **complex system** in that configurations of resources interact in a non-linear way.

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)

A high- or low-ability client may prefer an offering as an input, or an output, of coproduction



Rafael Ramirez and Johan Wallin. *Prime Movers: Define Your Business or Have Someone Define It Against You*, 2000, p. 141.

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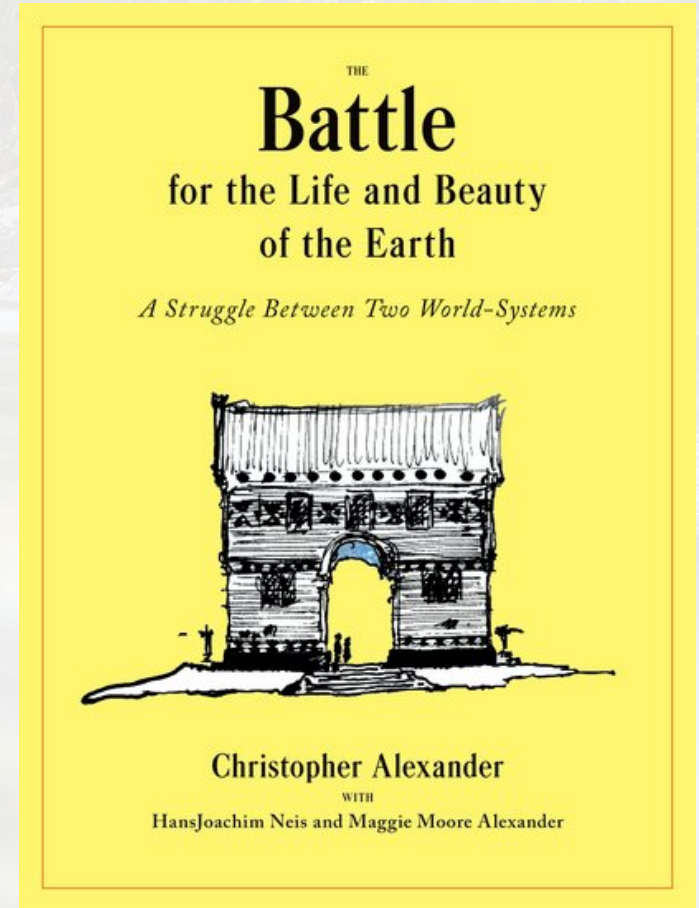
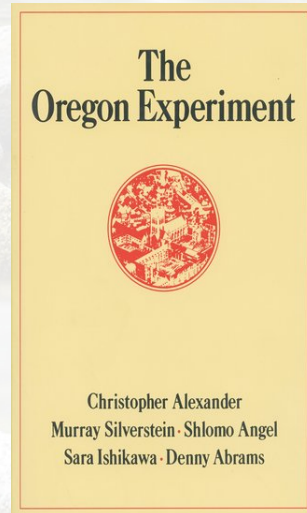
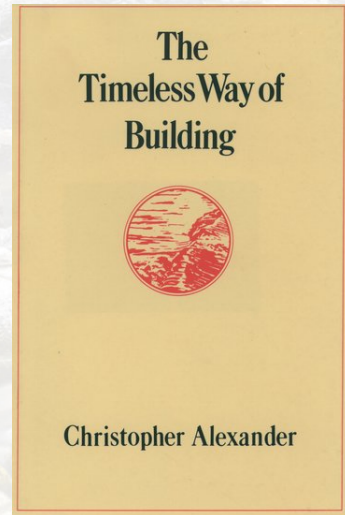
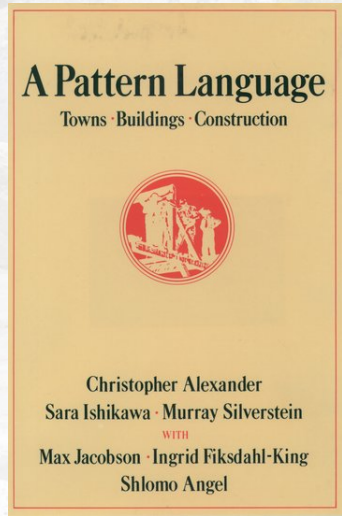
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The writing of 1975-1979 by Alexander was prescriptive;
the 2012 is reflections on practice



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

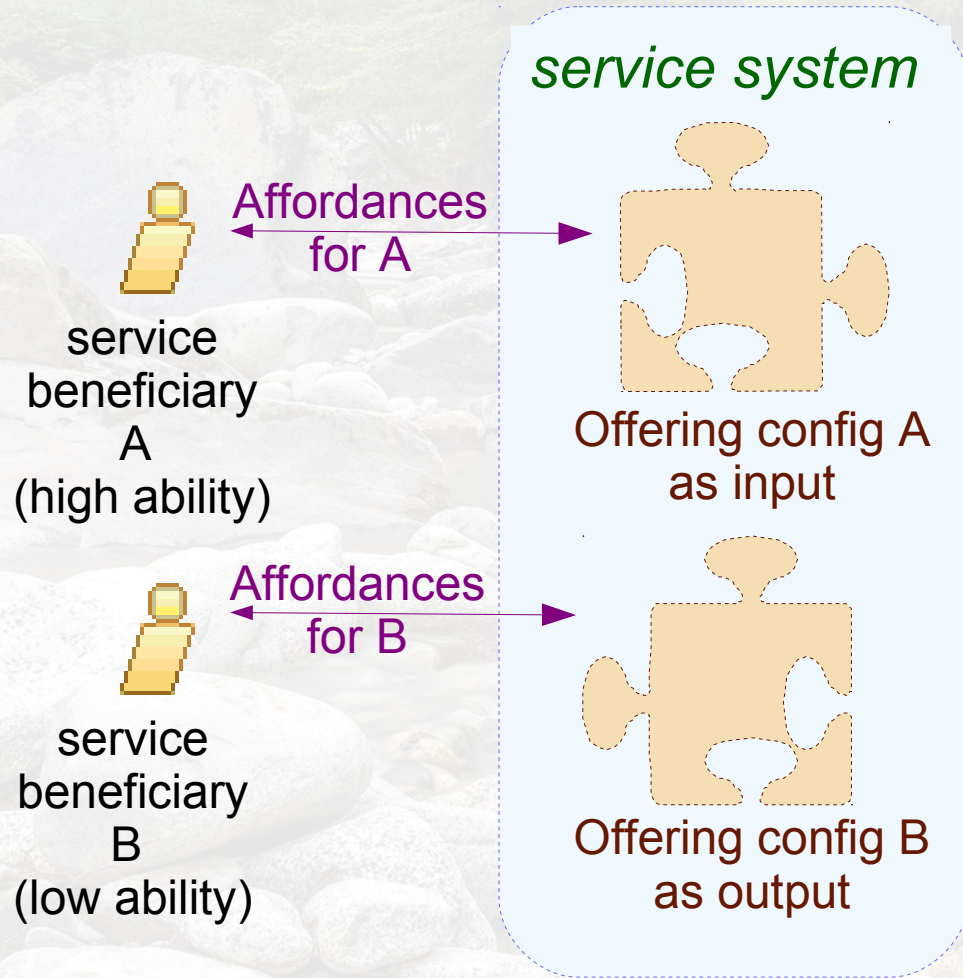
The kinds of patterns include:

- 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 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>

Affordances are relational in an ecological perception



The term *affordance* refers to whatever it is about the **environment** that **contributes** to the kind of **interaction** that occurs. [....]

An affordance relates attributes of something in the **environment** to an **interactive activity by an agent** who has some ability, and an ability relates attributes of an agent to an interactive activity with something in the environment that has some affordance.

The relativity of affordances and abilities is fundamental. Neither an affordance nor an ability is specifiable in the absence of specifying the other.

James G. Greeno 1994. "Gibson's Affordances." *Psychological Review* 101 (2): 336–342.



Publications

Submitted by daviding on Sat, 12/17/2016 - 00:18

Publication Date	Publication Title	Author(s)
February 2017	"Some Future Paths for Design Professionals: DesignX and Systemic Design [view article]	Susu Nousala, David Ing and Peter Jones
December 2016	"Service Systems Thinking with Generative Pattern Language" [view abstract and presentation slides]	David Ing
October 2016	"Pattern Manual for Service Systems Thinking: A proposal for discussion" [view abstract and article]	David Ing

Curriculum Making for Trto

2016/10/28 Pattern Manual for Service Systems Thinking

Submitted by daviding on Sun, 12/18/2016 - 00:19

Authors

David Ing

Abstract

What is properly required to take the learning on generative pattern languages from the built environment and software development communities, to a world of service system thinking?

This position paper winds back to early days of Center for Environmental Studies, and presents an alternative view on the 1968 Multi-Service Center work, informed by 21st century developments in service systems science. The conventional format for a pattern language has settled into a three-part rule of relations between context, problem and solution. An alternative format of (i) voices on issues (who + what), (ii) affording value(s) (how + why), and (iii) spatio-temporal frames (where + when) is proposed, with a straw man example.

Methods from the 1985 Eishin campus project, published in 2012, are compared against practices that have become common in agile development.

The conceptual shifts from built environment to service systems thinking are expressed as (i) amplifications, (ii) rephilosophizations, and (iii) reinterpretations. The generation and legitimization of pattern languages is considered across a community, with a shift from publishing in books on paper to collaborating with online technologies such as wiki.

At the 2014 PLoP and the 2015 PURPLSOC conferences, the idea of extending the pattern language for environment structure into a new domain of service systems thinking was introduced. In 2016, this idea has been further developed as a baseline for further discussion

Citation

David Ing, "Pattern Manual for Service Systems Thinking: A proposal for discussion", *Proceedings of the 2016 International PUARL Conference*.

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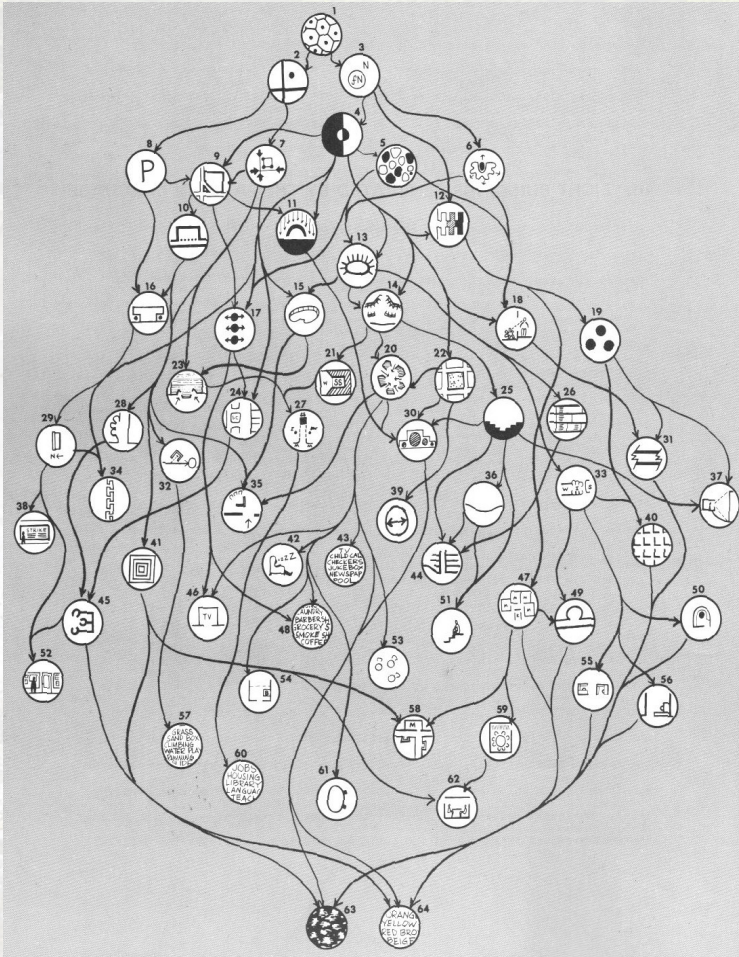
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At the 2014 PLoP and the 2015 PURPLSOC conferences, the idea of extending the pattern language for environment structure into a new domain of service systems thinking was introduced. In 2016, this idea has been further developed as a baseline for further discussion.

Keywords: *service systems; systems thinking; issue-seeking; interactive value; wayfaring*

Pattern language intends to give 3 types of help



1. It gives him the opportunity to use the patterns in the way which pays full respect to the **unique features** of each special building: the local peculiarities of the community, its special needs ...
2. It tells him which patterns to consider **first**, and which ones to consider **later**. Obviously he wants to consider the **biggest ones** ... before he considers the **details**.
3. It tells him which patterns "**go together**" ... so that he knows which ones to think about at the same time, and which ones separately (Alexander et al., 1968, pp. 17–19).

Try who+what, how+why, where+when, containing, contained

(i) Pattern label	Tapping into the grapevine	Signing in for services	Minding children
	◇ ◇ ◇	◇ ◇ ◇	◇ ◇ ◇
(ii) Voices on issues (who and what)	(a) For a client, what jobs and training are available? (b) For a neighbour, in what ways can we share and update community news?	(a) For a client, what services are available to me, now and on appointment? (b) For a parent, what do I do with my kids while I'm busy? (c) For a child, what can I do while my parent is at the MSC?	
(iii) Affording value(s) (how and why)	Displaying up-to-date news and local information, so that individuals can know ways to independently act. Adding, revising and moderating community contributions so that individual and authoritative viewpoints are balanced.	Matching client needs with MSC resources, so that holistic treatments are received. Triaging and scheduling so that urgent cases are prioritized, and wait times are tolerable	Leaving a child at a supervised play area so that whereabouts are known. Availing distractions for toddlers through teens, so that coming with parents is less of a chore
(iv) Spatio-temporal frames (where and when)	Access to information onsite MSC for clients who don't have devices, and on the open Internet for the public	On demand lookups of trending and prior MSC busy and slow periods transparently visible onsite and on the Internet, enabling clients to adjust and/or rebook	Facilities and programs are known both to children and parents in advance of appointments
	◇ ◇ ◇	◇ ◇ ◇	◇ ◇ ◇
(v) Containing systems (slower and larger)	For municipal, regional and national agencies, are community health and social services in their jurisdictions well provide?		For extended family, schools and community workers, what personal responsibilities inhibit service engagement?
vi) Contained systems (faster and smaller)	For neighbours in mutual support, friends and family ties, who should know about news?	For friends or assistants speaking on behalf or interpreting for a client, is the situation understood?	For other parents at the MSC at the same time, would you look after my kids like I look after yours?

Minding children: who+what, how+why, where+when, containing, contained

(i) Pattern label	Minding children
	◇ ◇ ◇
(ii) Voices on issues (who and what)	(a) For a client, what services are available to me, now and on appointment? (b) For a parent, what do I do with my kids while I'm busy? (c) For a child, what can I do while my parent is at the MSC?
(iii) Affording value(s) (how and why)	Leaving a child at a supervised play area so that whereabouts are known. Availing distractions for toddlers through teens, so that coming with parents is less of a chore
(iv) Spatio-temporal frames (where and when)	Facilities and programs are known both to children and parents in advance of appointments
	◇ ◇ ◇
(v) Containing systems (slower and larger)	For extended family, schools and community workers, what personal responsibilities inhibit service engagement?
(vi) Contained systems (faster and smaller)	For other parents at the MSC at the same time, would you look after my kids like I look after yours?

Alexandrian format mapped to proposed service systems thinking

Format for service systems thinking

(i) Pattern label	An interaction phrased as a present participle
(ii) Voices on issues (who and what)	Archetypal roles of stakeholders, with concerns and interests posed as questions
(iii) Affording value(s) (how and why)	Objects and/or events that enable modes of practised capacities for independent or mutual action
(iv) Spatio-temporal frames (where and when)	Occasions at which dwelling in issues and affordances are salient and at hand
(v) Containing systems (slower and larger)	Constraining conditions in which the pattern operates, potentially where multi-issue messes are dissolved
(vi) Contained systems (faster and smaller)	Opportunistic conditions which the pattern contains, potentially allowing ad hoc resolving of a specific issue at hand

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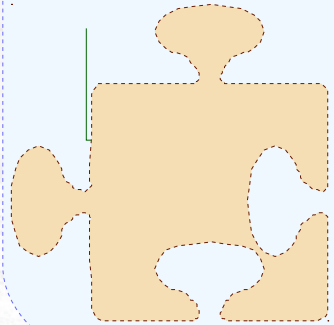
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Systems thinking is a perspective on wholes, parts and their relations

containing
whole

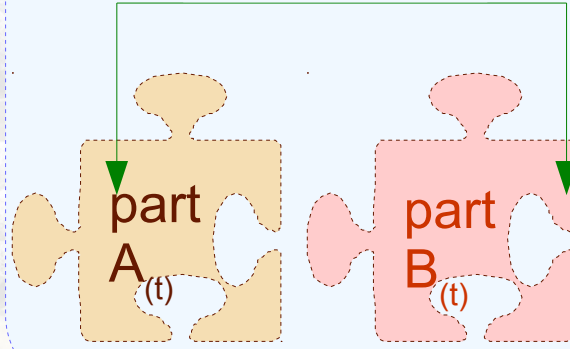
↑
Function (non-living)
or role (living)



Function

“contribution of the
part to the whole”

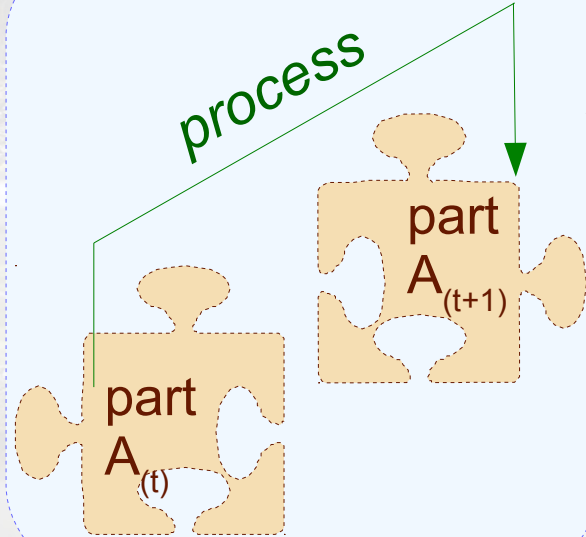
structure



Structure

“arrangement in
space”

process



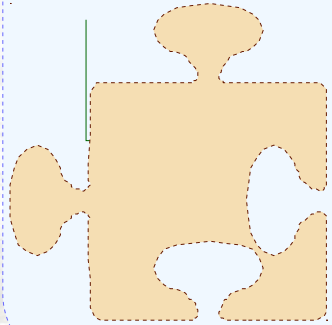
Process

“arrangement in
time”

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

containing
whole

↑
*Function (non-living)
or role (living)*



Synthesis precedes analysis

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

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

Panarchy theory and resilience science see system connections to larger-slower levels, and smaller-faster levels

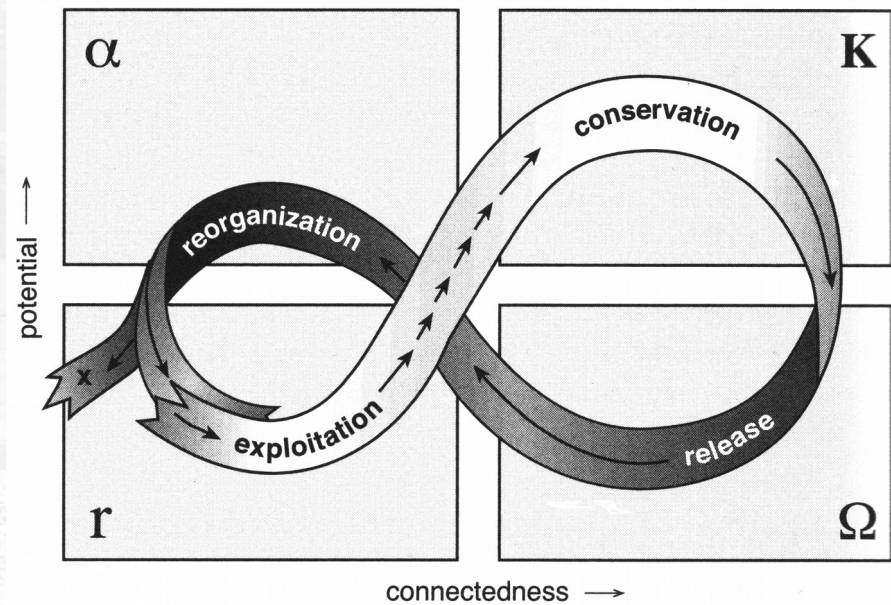
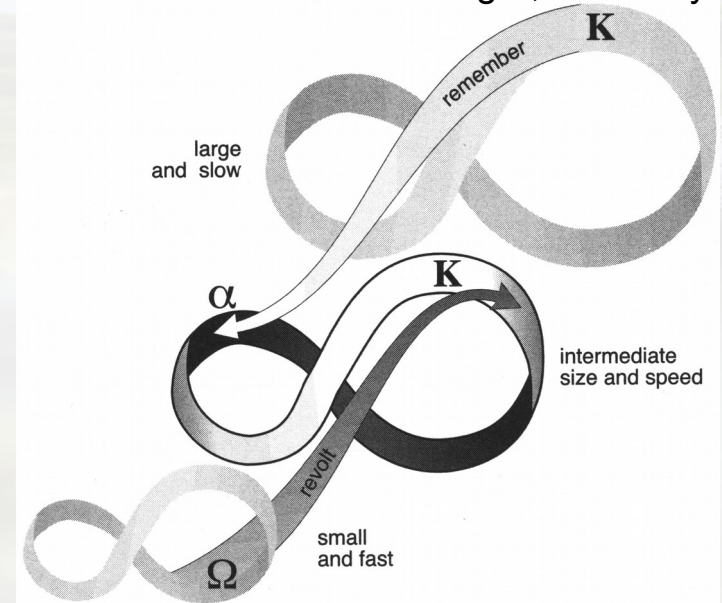


Figure 4. A stylized representation of the four ecosystem functions (r, K, Ω, α) and the flow of events among them.

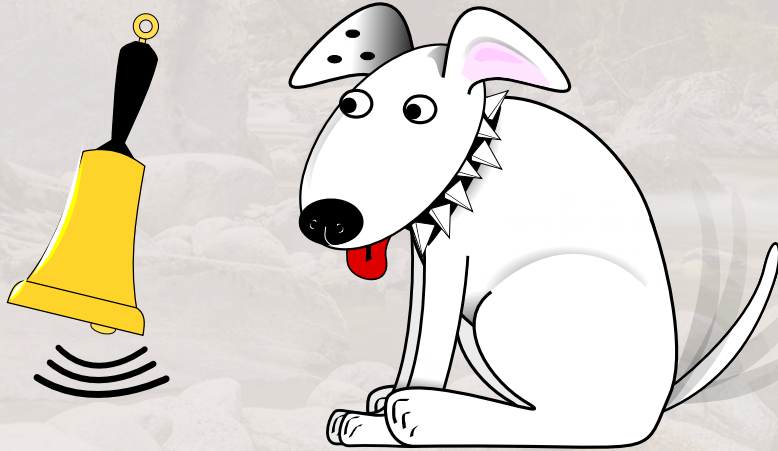
Figure 7. Panarchical connections. [...] the “revolt” connection ...can cause a critical change in one cycle to cascade up to a vulnerable stage in a larger and slower one. The ... “remember” connection ... facilitates renewal by drawing on the potential that has been accumulated and stored in a larger, slower cycle.



Source: C. S. Holling 2001. “Understanding the Complexity of Economic, Ecological, and Social Systems.” *Ecosystems* 4 (5): 390–405. doi:10.1007/s10021-001-0101-5. <http://dx.doi.org/10.1007/s10021-001-0101-5>.

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

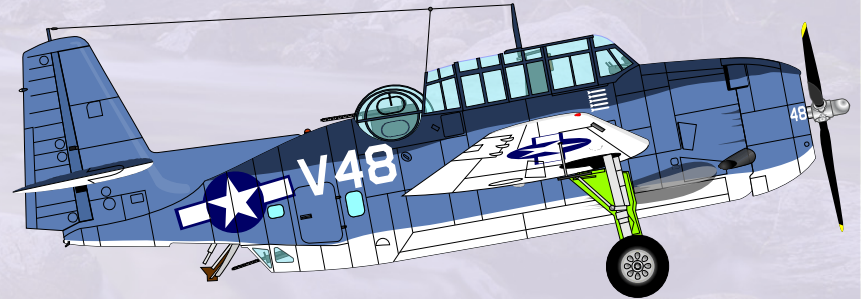
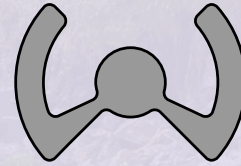
Stimulus – Response (Behavioral Psychology)



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

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

Ecological Approach to Perception



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

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



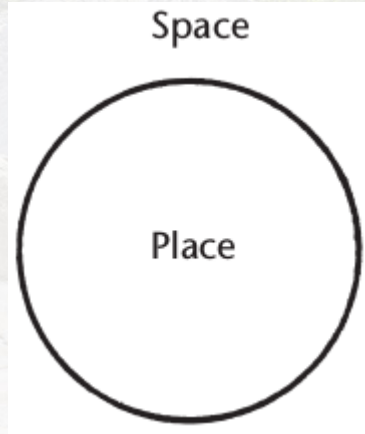
I have folded the organism in on itself such that it is delineated and contained within a perimeter boundary, set off against a surrounding world – an environment – with which it is destined to interact according to its nature. The organism is ‘in here’, the environment ‘out there’.

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



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

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



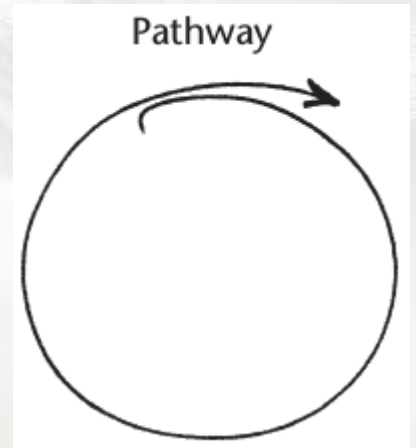
For the Inuit, as soon as a person moves he becomes a line.

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

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

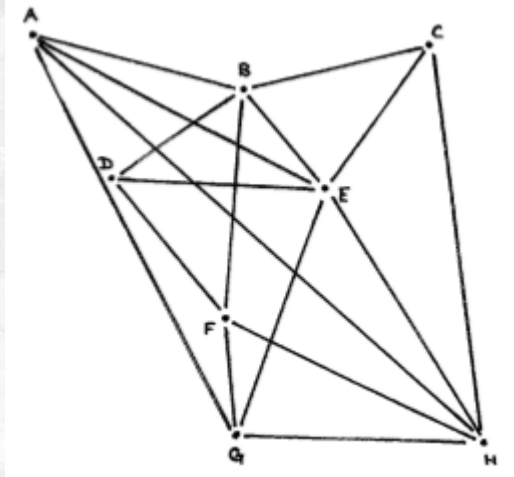
My contention is that lives are led not inside places but through, around, to and from them, from and to places elsewhere

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

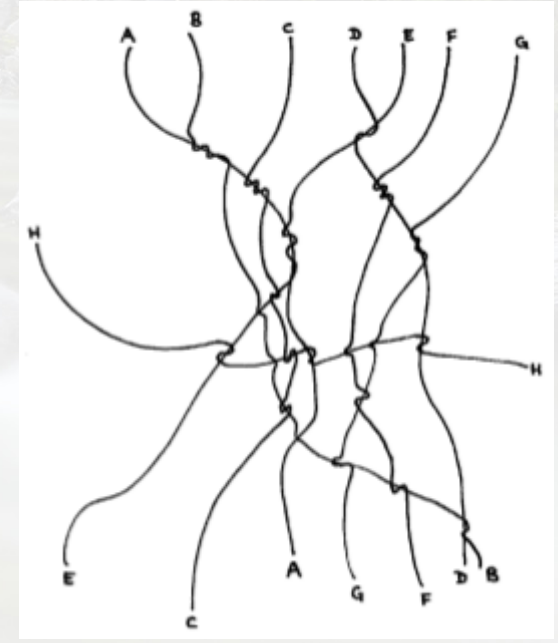


Tim Ingold. 2011. "A storied world." In *Being Alive: Essays on Movement, Knowledge and Description*, p. 148-149.

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



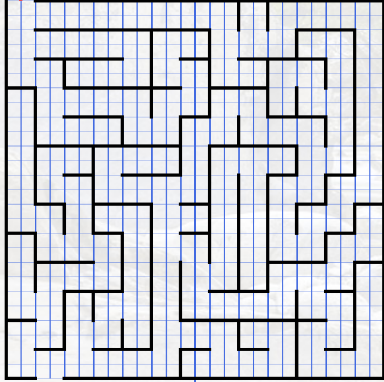
The lines of a network, in its contemporary sense, join the dots. They are connectors.



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

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

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



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

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



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

Agenda

1. Architecting ↔ designing

2. Service systems ← production systems

3. Affordances ↔ pattern language

4. Ecological anthropology ← teleology

5. Inquiring systems ↔ methods

Pattern manual as an initial position for a community of practice

A Pattern Language

- The original 253 patterns in effect became frozen in time
- The publisher has not released the content of the patterns into the public domain
- A severe constraint on the further use, modification and addition to pattern languages (Cunningham & Mehaffy, 2013, p. 6)

→

- Federated wiki?

The design of inquiring systems

<i>Way of knowing</i>	<i>Inquiring System</i>	<i>Philosopher</i>
First	Inductive Consensual (agreement)	John Locke
Second	Analytic Deductive (fact nets)	Gotfried Wilhelm Leibniz
Third	Multiple Realities (representations)	Immanuel Kant
Fourth	Dialectic (conflict)	Georg Wilhelm Friedrich Hegel
Fifth	Systems Approach (progress, sweeping in)	Edgar Arthur Singer; C. West Churchman

From System-B to System-A, c.f. from waterfall to agile

From System-B to System-A		From waterfall methods to agile	
(i) Pattern language for the community	From preprogrammed assembly to local adaptation with feedback and correction	(i) Writing user stories	From detailing specifications to conversing on narratives
(ii) Construction budget	From overemphasizing tangible aspects to negotiating collective feelings	(ii) Scoping; estimating value, costs and dates	From projecting and committing to converging on estimates
(iii) Reality of the land	From drawing abstract layout plans to adjusting the wholeness on the real site	(iii) Reviewing iteratively; tracking work item backlogs	From dividing-and-conquering to collaborating for learning

Amplifications from Alexandrian to service systems thinking

1.	Shared meaning on the situated	<p>The pattern is merely a mental image, which can help to predict those situations where forces will be in harmony, and those in which they won't. But the actual forces which will occur in a real situation, although objectively present there, are, in the end unpredictable, because each situation is so complex, and forces may grow, or die, according to subtle variations of circumstance (Alexander, 1979, pp. 285–286).</p>
2.	Systems thinking and complexity	<p>Systems generating systems</p> <ol style="list-style-type: none">1. There are two ideas hidden in the word system: the idea of a system as a whole and the idea of a generating system.2. A system as a whole is not an object but a way of looking at an object. It focuses on some holistic property which can only be understood as a product of interaction among parts.3. A generating system is not a view of a single thing. It is a kit of parts, with rules about the way these parts may be combined.4. Almost every 'system as a whole' is generated by a 'generating system'. If we wish to make things which function as 'wholes' we shall have to invent generating systems to create them. <p>In a properly functioning building, the building and the people in it together form a whole: a social, human whole. The building systems which have so far been created do not in this sense generate wholes at all (Alexander, 1968, p. 605).</p>
3.	Method content + development process	<p>Volume 1, The Timeless Way of Building [TWB], and Volume 2, A Pattern Language [APL], are two halves of a single work. This book [APL] provides a language, for building and planning; the other book [TWB] provides the theory and instructions for the sue of the language. This book [APL] describes the detailed patterns for towns and neighbourhoods, houses, gardens and rooms. The other book [TWB] explains the discipline which makes it possible to use these patterns to create a building or a town. This book [APL] is the sourcebook of the timeless way; the other [TWB] is its practice and its origin (Alexander et al., 1977, p. ix).</p>

Rephilosophizations from Alexandrian to service systems thinking

1.	From structuralism to alternative stable states	<ul style="list-style-type: none">• Criticism of teleology• Three types of change in biological evolution: (i) environmental change; (ii) somatic (cellular) change; and (iii) genotypic change (Bateson 1963)• Teleonomic processes through closed programs or open programs• Regime shifts (ecosystem ecology, community ecology)
2.	From dwelling to journeying	<ul style="list-style-type: none">• Being served over a period of time (a journey) rather than in a moment of time (dwelling)?• Heidegger world-time and time-as-ordinarily-conceived• Places existing not in space, but as nodes in a matrix of movement (Ingold 2000)
3.	From semi-lattice to meshwork	<ul style="list-style-type: none">• "A City is Not a Tree" focuses on physical invariants• Social relations with movement and time (e.g. gaining and losing friends)• Each person not as a point, but as a line (Ingold 2011)• Meshworks as trails of movements or growth

Reinterpretations from Alexandrian to service systems thinking

1.	From problem-solving to issue-seeking	<ul style="list-style-type: none">• Design is problem-solving; [architectural] programming is problem-seeking (Peña & Focke, 1969, p. 4).• Issues-based approach appreciating how values influence and impact defining problems (Rittel & Webber, 1973, p. 159).• Problem Structuring Methods (e.g. Soft Systems Methodology, Strategic Choice Approach, Strategic Options Development and Analysis)
2.	From quality-wholeness to interactive value	<ul style="list-style-type: none">• "Quality without a name" – "an objective quality that things ... can possess that makes them good places or beautiful places. (Gabriel 1996)• 15 geometric invariants, mutually-reinforcing centers• Services separating value from the outcome• Interactive value: enjoyment takes place over time• Outcomes of service systems: use-value, exchange value
3.	From anti-patterns to wayfaring	<ul style="list-style-type: none">• Dead patterns leak out, infect other patterns (Alexander 1979)• Anti-patterns as non-solutions; to be coupled with patterns in pairs (towards problem-solving)• Wayfaring more equivalent to piecemail growth (than transport from origin to destination)

With known knowns in science eroding by systemic world changes, collective learning on why, how + when-where-whom gains value



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

[1] Ing, David, Minna Takala, and Ian Simmonds. 2003. "Anticipating Organizational Competences for Development through the Disclosing of Ignorance." In Proceedings of the 47th Annual Meeting of the International Society for the System Sciences. Hersonissos, Crete.
http://systemicbusiness.org/pubs/2003_ISSS_47th_Ing_Takala_Simmonds.html

If they can get you asking the wrong questions, they don't have to worry about answers (Thomas Pynchon)

Type **1** error **False positive:**
finding a (statistical) relation that isn't real

Type **2** error **False negative:**
missing a (statistical) relation that is real

Type **3** error **Tricking ourselves:**
Unintentional error of solving wrong problems precisely
(through ignorance, faulty education or unreflective practice)

Type **4** error **Tricking others:**
Intentional error of solving wrong problems
(through malice, ideology, overzealousness, self-righteousness,
wrongdoing)

Ian I. Mitroff and Abraham Silvers. 2010. *Dirty Rotten Strategies: How We Trick Ourselves and Others into Solving the Wrong Problems Precisely*. Stanford University Press.

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