

# Systems Changes

## Errors and Breakdowns; Approaches; Learning

David Ing

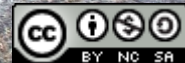
<http://coevolving.com>

OCADU MDes SFI

Toronto, Ontario

March 2019

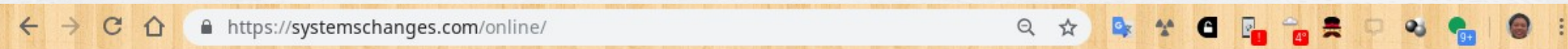
Image CC-BY Mike Cassano (2009) *Most Interesting Pothole*



David Ing, 2019



# Join us in collaborating on a *Systems Changes* research program



## Systems Changes

Home Participation Social\_Innovation Learning About



In which *systems* would you like to see *changes* occur?

*Systems Changes* is a collaborative open research program, initiated from Toronto, Canada. A call for participation was launched in January 2019 at the monthly Systems Thinking Ontario meeting. The web site will evolve as contributions and knowledge are added.

The plurals in the program name are significant.

- There are multiple **systems** simultaneously at play, not just a single system.
- **Changes** include those within a field that individual and groups can influence, and those in an extended environment that are beyond our abilities.

The program is initially facilitated by David Ing. Collective learning is encouraged with the cooperation of Systems Changes program members.

# Agenda

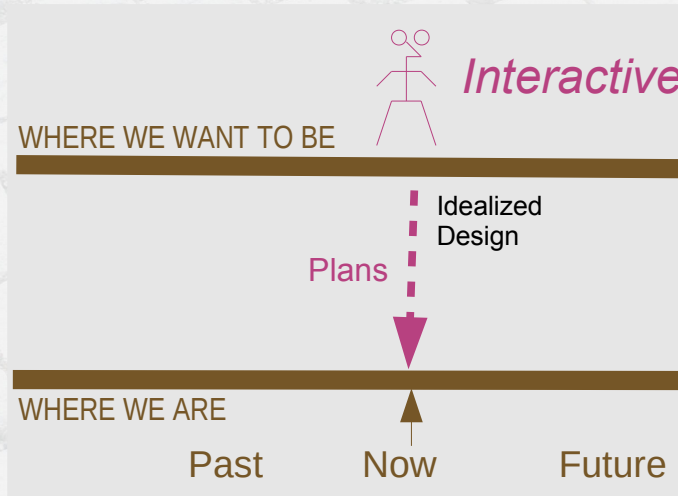
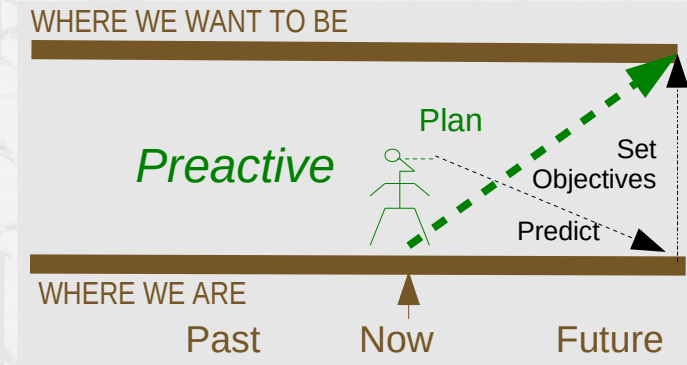
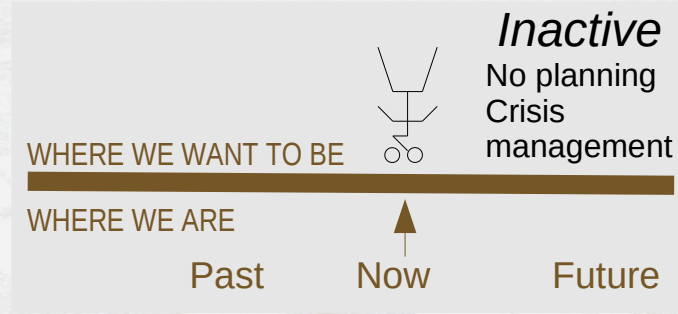
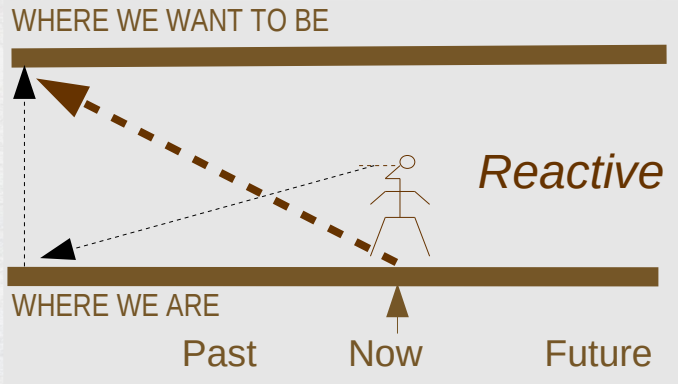
[preamble] Systems Changes and Action

- A. (Human) Errors + (Systems) Breakdowns
- B. Systems Approaches: Behavioral + Ecological
- C. Action Learning + Pattern Sequences

[postscript] Multi-Paradigm Inquiry



# What are your orientations on systems changes over time?



Russell L. Ackoff. 1999.  
*Re-creating the Corporation:  
A Design of Organizations  
for the 21st Century.*  
Oxford University Press.



# Willful action and non-intrusive action are central in Chinese thinking

為

wèi

無為

wú wèi

为 (為) wéi: p. 517

I (动, verb)

1. **do; act**: 敢做敢 ~ gǎn zuò gǎn ~ bold in action
2. **act as; serve as**: 以此 ~ 凭 yǐ cǐ ~ píng This will serve as proof.
3. **become**: 变沙漠 ~ 良田 biàn shā mó ~ liáng tiān turn the desert into arable land.
4. **be; mean**: 一公里 ~ 二华里 yī gōng lǐ ~ èr huā lǐ One kilometer is equivalent to two li.

无 (無) wú: p. 526

I (名, noun) **nothing; nil**: 从 ~ 到有 cóng ~ dào yǒu start from scratch

II (动, verb) **not have; there is not; without**: ~ 一定计划 ~ yī dìng jì huà have no definite plan

III (副, adverb) **not**: ~ 须多谈 ~ xǔ duō tán need not go into details

*Concise English-Chinese Chinese-English Dictionary* (2004), 3ed, Commercial Press and Oxford University Press

**Wei** meant application of **the force of will-power**, the **determination** that things, animals, or even other men, should do what they were ordered to do, but

**wu wei** was the opposite of this, **leaving things alone**, letting **Nature** take her course, profiting by **going with the grain** of things instead of going against it, and **knowing how not to interfere**.

Needham, Joseph. 2004. "General Conclusions and Reflections." In *The Social Background*, edited by Kenneth Girdwood Robinson. Vol. VII:2. *Science and Civilisation in China*. Cambridge University Press. p. 16

Some scholars have argued that the interpretation of **wuwei** as "**non-intrusive action**" or "**non-interfering action**" is more philosophically profound and interesting.

These latter translations support a meaningful rendition of the concept **wuwei both at the sociopolitical level** (arguing against the imposition of artificial, conformist and universally binding norms) **and at the metaphysical level** (acknowledging the inappropriateness and fatality of imposing egocentric or anthropocentric norms upon other individuals or species).

Lai, Karyn. 2003. "Conceptual Foundations for Environmental Ethics: A Daoist Perspective." *Environmental Ethics* 25 (3): 247–66. <https://doi.org/10.5840/enviroethics200325317>.



# What is the way of *castor canadensis* (beaver) in habitats?



Image: CC-BY D.W. Ross (2010) "North American Beaver"



Image: CC-BY Steve HERSHEY (2007) "Happy Beaver"









Image: CC-BY Jay Cross (2012) "Other End of the Beaver Dam"





Image: CC-BY Bob Smith (bobistraveling) (2017) "Broken Beaver Dam"



# What is the way of humans with technology?

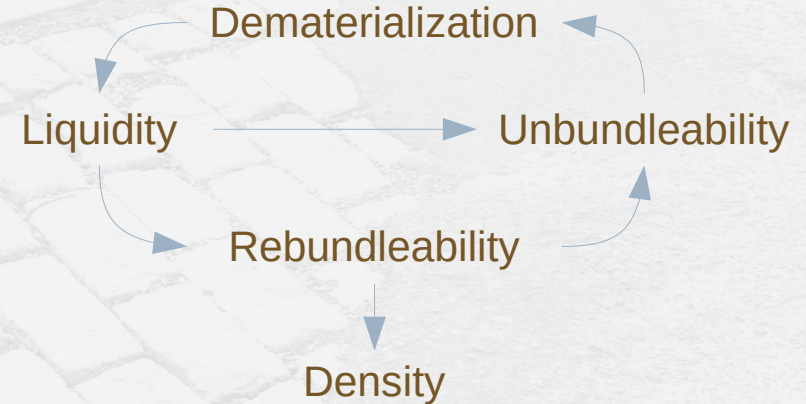
[The] '**principle of density**' [sees the] best **combination of resources** is **mobilized** for a **particular situation** – e.g. for a customer at a given time in a given place – independent of location, to create the optimum value/cost result.

The **effect of technology** is – and always has been – to **loosen constraints**. As a result of technological development, **what was not possible becomes possible**. Or **what was not economically feasible becomes so**.

Today's new technology ... liberates us from constraints particularly in terms of:

- Time **When** things can be done
- Place **Where** things can be done
- Actor **Who** can do what
- Constellation **With whom** it can be done.

*'Density' expresses the degree to which such mobilization of resources for a 'time / space / actor' unit can take place.*



[Restructuring] implies two basic processes. [...]

The **first** of this setting of driving forces, thus, is related to the ability to 'break up', or to **unbundle**; the second to the ability to 'link' and 'put together' or to **rebundle**.

Normann, Richard. 2001. *Reframing Business*. New York: Wiley. Chapter 2.



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B. Systems Approaches: Behavioral + Ecological

C. Action Learning + Pattern Sequences

[postscript] Multi-Paradigm Inquiry



# Errors contrasted with breakdowns frame different appreciations



(1)  
(2)  
(3)



# Errors contrasted with breakdowns frame different appreciations

## Errors

### Systematic

- Design as an orderly sequence of activities (via an earlier designers and engineers)
- Steps or phases in logical and linear arrangement
- Keeps apart logic from imagination, and problem from solution through external will

### Reformation

- 
- 

### Complicatedness

- 

## Breakdowns

### Systemic

- Design as creative, disciplined, decision-oriented inquiry, in iterative cycles
- Not linear or sequential integration of information and knowledge
- Feedback - feedforward; reflection - creation; divergence - convergence

### Transformation

- 
- 

### Complexity

- 

(1)

(2)

(3)

(1) Banathy, Bela H. 1996. *Designing Social Systems in a Changing World*. Springer. <http://dx.doi.org/10.1007/978-1-4757-9981-1>, p. 16

(2)

(3)



# Errors contrasted with breakdowns frame different appreciations

## Errors

### Systematic

- 
- 
- 

(1)

- 
- 
- 

### Reformation

- Moderate change in behavior without changing structure or function
- Do kinds of things as it has always done, some differently

(2)

- Radical change in structure and function, often in response to change environment
- May involve risk, willingness to make short-term sacrifices for longer-term gains.

### Complicatedness

- 

(3)

- 

## Breakdowns

### Systemic

### Transformation

### Complexity

(1)

(2) Ackoff, Russell Lincoln. 1999. *Re-Creating the Corporation: A Design of Organizations for the 21st Century*. Oxford University Press. Ackoff, Russell Lincoln. 2010. *Differences That Make a Difference: An Annotated Glossary of Distinctions Important in Management*. Triarchy Press Limited.

(3)



# Errors contrasted with breakdowns frame different appreciations

## Errors

### Systematic

•

•

•

### Reformation

•

•

### Complicatedness

- Elaboration of structure (i.e. more alongside)

## Breakdowns

### Systemic

(1)

•

•

•

### Transformation

(2)

•

•

### Complexity

(3)

- Elaboration of organization (i.e. more levels)

(1)

(2)

(3) Allen, Timothy F. H., Joseph A. Tainter, and Thomas W. Hoekstra. 1999. "Supply-Side Sustainability." *Systems Research and Behavioral Science* 16 (5): 403–27.

[https://doi.org/10.1002/\(SICI\)1099-1743\(199909/10\)16:5<403::AID-SRES335>3.0.CO;2-R](https://doi.org/10.1002/(SICI)1099-1743(199909/10)16:5<403::AID-SRES335>3.0.CO;2-R).

Systems Changes: Errors and Breakdowns; Approaches; Learning

March 2019



David Ing, 2019



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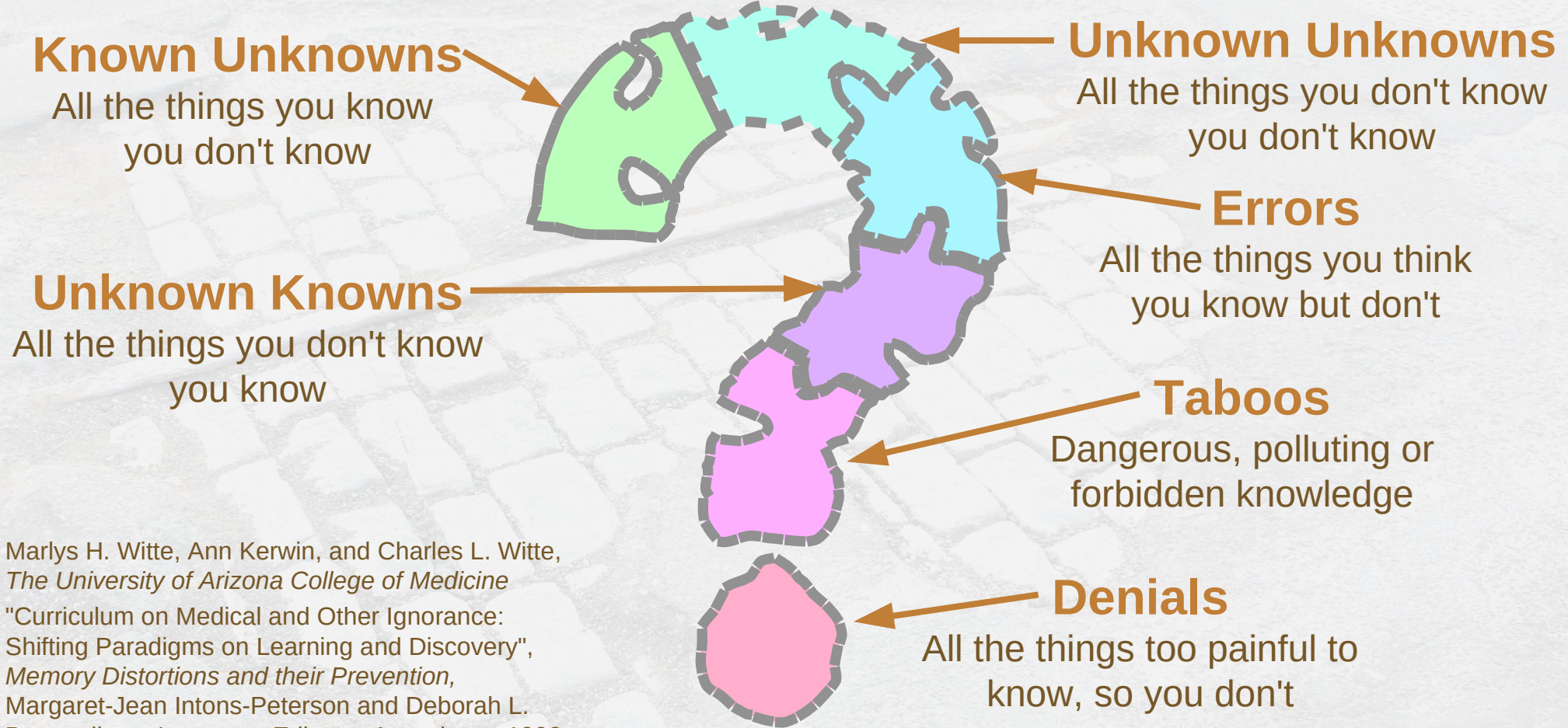
(1) Banathy, Bela H. 1996. *Designing Social Systems in a Changing World*. Springer. <http://dx.doi.org/10.1007/978-1-4757-9981-1>, p. 16

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# The *Ignorance Map* cautions physicians against overconfidence



Marlys H. Witte, Ann Kerwin, and Charles L. Witte,  
*The University of Arizona College of Medicine*  
"Curriculum on Medical and Other Ignorance:  
Shifting Paradigms on Learning and Discovery",  
*Memory Distortions and their Prevention*,  
Margaret-Jean Intons-Peterson and Deborah L.  
Best, editors, Lawrence Erlbaum Associates, 1998



# Errors in decision-making may come from gaps in knowledge

There are two possible types of decision-making mistakes, which are not equally easy to identify.



(1) **Errors of commission:**  
doing something that should  
not have been done.

(2) **Errors of omission:**  
not doing something that  
should have been done.

Accounting systems are able to  
identify errors of commission,  
even though they often fail to do so.

Decisions not to do something are  
seldom a matter of record.



Ackoff, Russell L. 1994. "It's a Mistake!" *Systems Practice* 7 (1): 3–7. <https://doi.org/10.1007/BF02169161>.

Images: CC-BY Mike McBey (2010) "Pisa"; CC-BY Robert Couse-Baker (2017) "This Way or That"



# Judgment under uncertainty relies on heuristics → 12 cognitive biases

## A. Representativeness

1. Insensitivity to prior probability of outcomes
2. Insensitivity to sample size
3. Misconceptions of chance
4. Insensitivity to predictability
5. The illusion of validity
6. Misconceptions of regression

## B. Availability

7. Biases due to the retrievability of instances
8. Biases due to the effectiveness of a search set
9. Biases of imaginability
10. Illusory correlation

## C. Adjustment and Anchoring

11. Insufficient adjustment
12. Anchoring in the assessment of subjective probability distributions

Tversky, Amos, and Daniel Kahneman. 1974. "Judgment under Uncertainty: Heuristics and Biases." *Science* 185 (4157): 1124–31.  
<https://doi.org/10.1126/science.185.4157.1124>.



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

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

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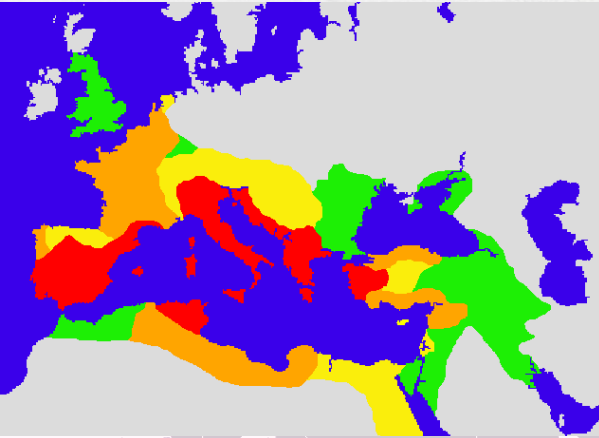
Type 4 error **Tricking others:**  
Intentional error of solving wrong problems (through malice, ideology, overzealousness, self-righteousness, wrongdoing)

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.

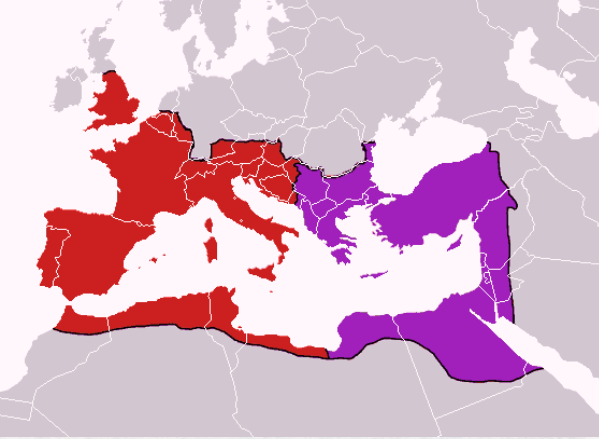


# Breakdowns in history see expansion and collapse –

## 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)

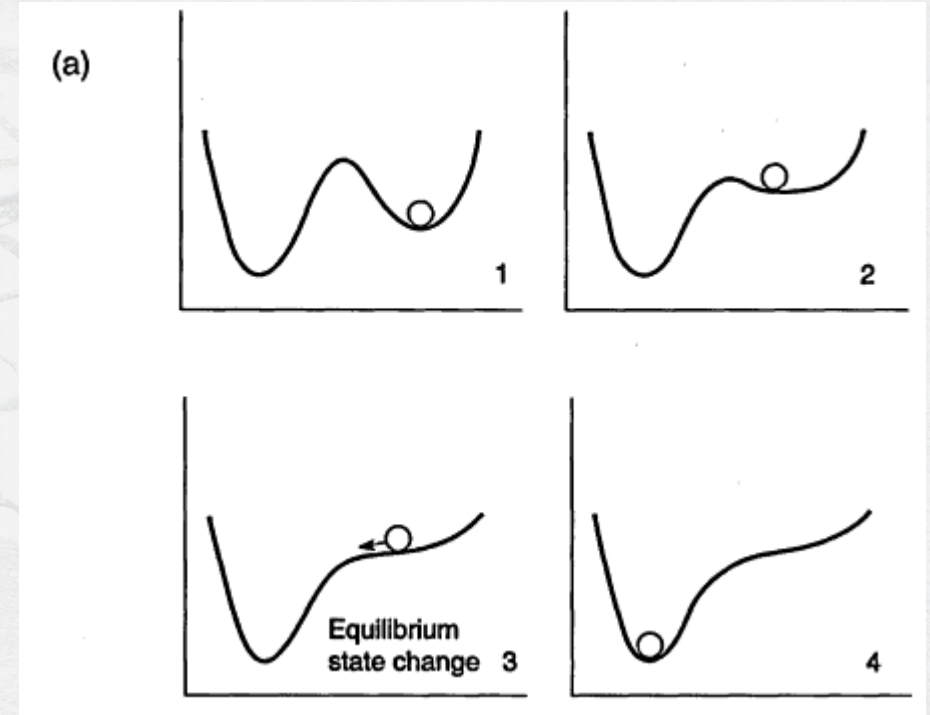
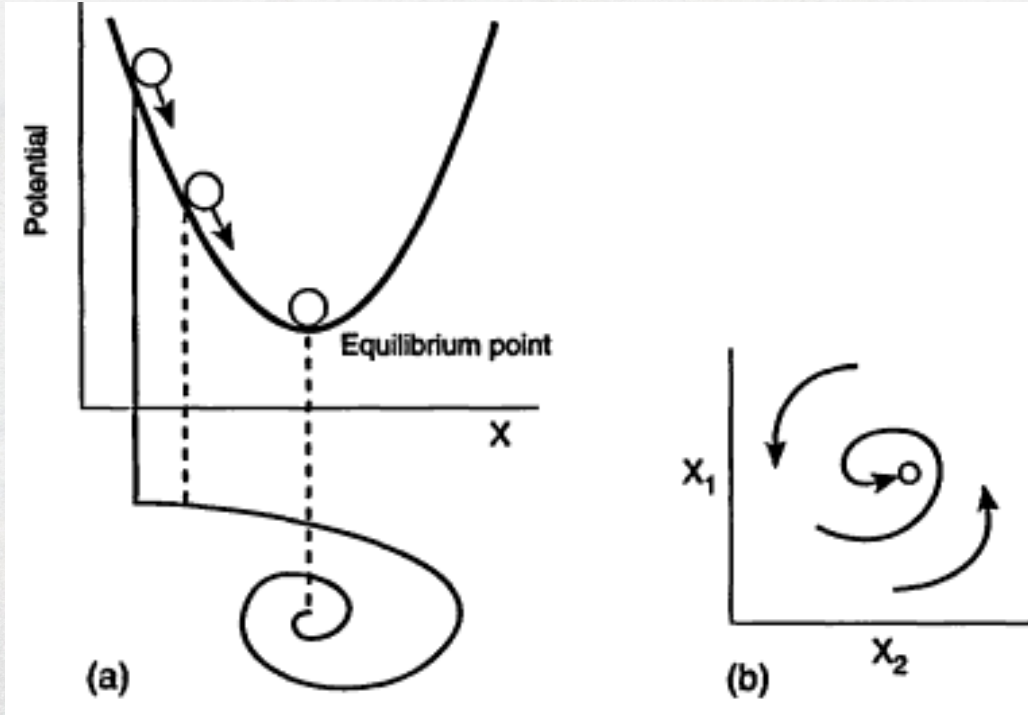


The Byzantine Empire and its provinces at the death of Basil II, 1025

Source: Atlas of Ancient Rome at [https://commons.wikimedia.org/wiki/Atlas\\_of\\_Ancient\\_Rome](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](https://commons.wikimedia.org/wiki/Atlas_of_the_Byzantine_Empire)



Engineering resilience returns to a single equilibrium steady state;  
ecological resilience allows for multiple stable states in nature



Holling, C.S. 1996. "Engineering Resilience versus Ecological Resilience." In *Engineering Within Ecological Constraints*, edited by Peter C. Schultze, 31–44. Washington, DC: National Academies Press. <https://doi.org/10.17226/4919>.



# Regime shifts occur when limits on thresholds are exceeded

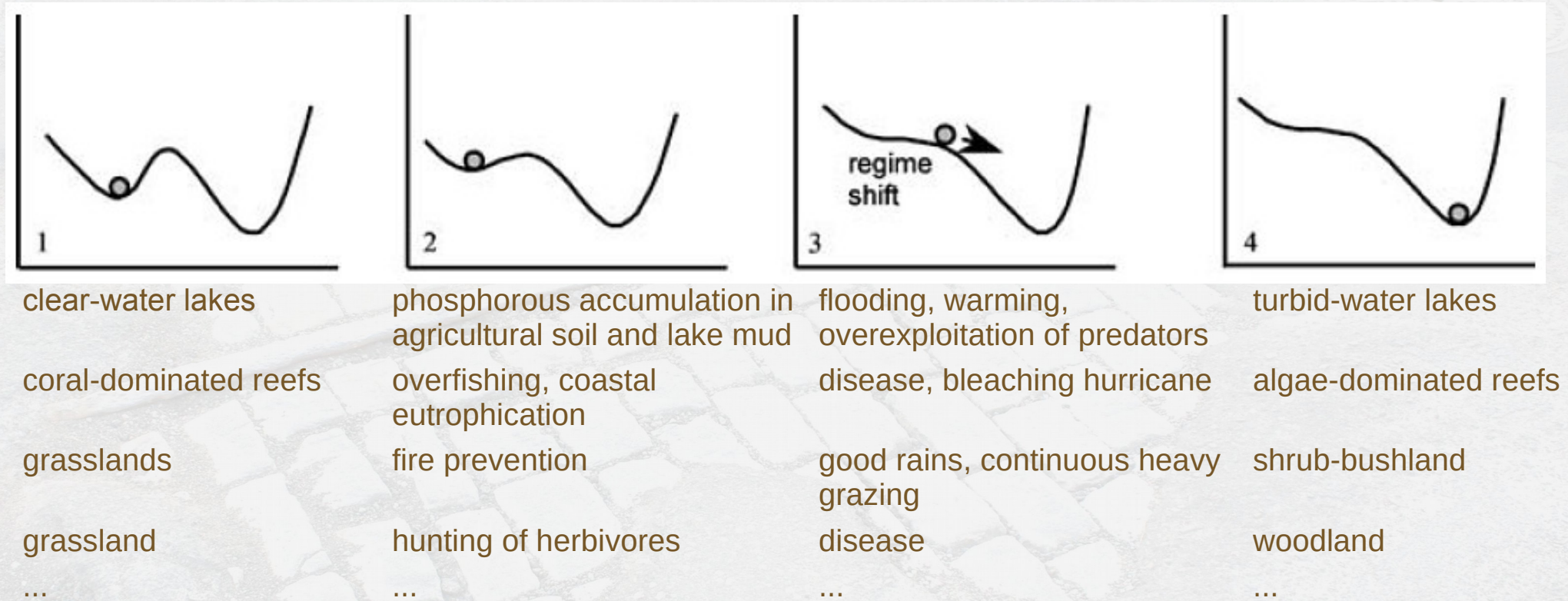


Figure 2: Alternate states in a diversity of ecosystems (1, 4) and the causes (2) and triggers (3) behind loss of resilience and regime shifts.

Folke, Carl, Steve Carpenter, Brian Walker, Marten Scheffer, Thomas Elmqvist, Lance Gunderson, and C.S. Holling. 2004. "Regime Shifts, Resilience, and Biodiversity in Ecosystem Management." *Annual Review of Ecology, Evolution, and Systematics* 35 (1): 557–81. <https://doi.org/10.1146/annurev.ecolsys.35.021103.105711>.



# Adaptive cycle has two dimensions of change: potential and connectedness

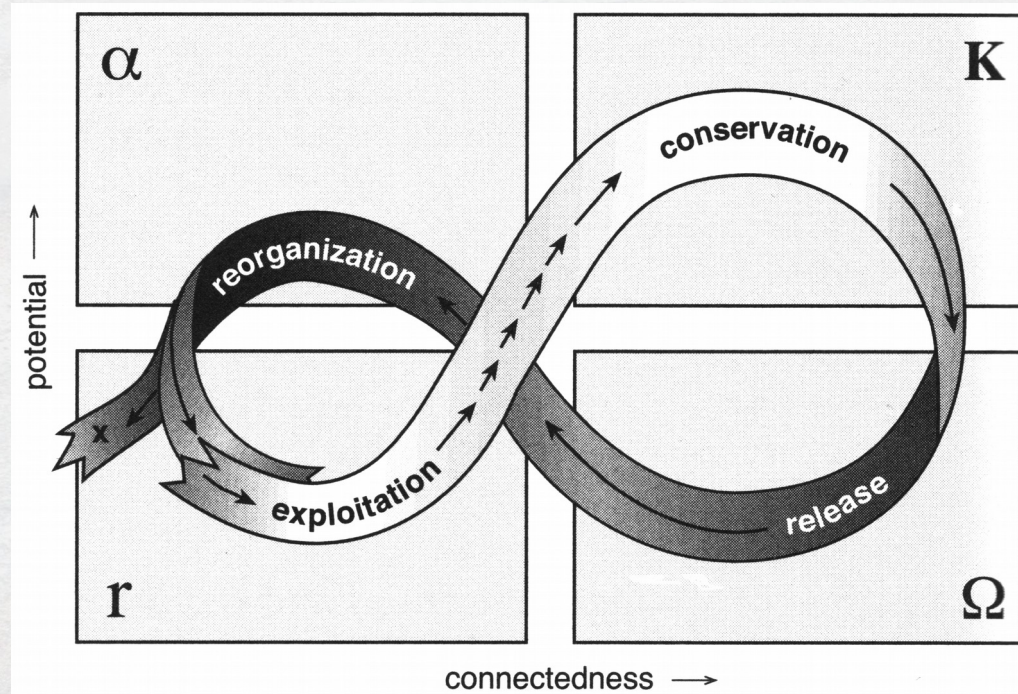
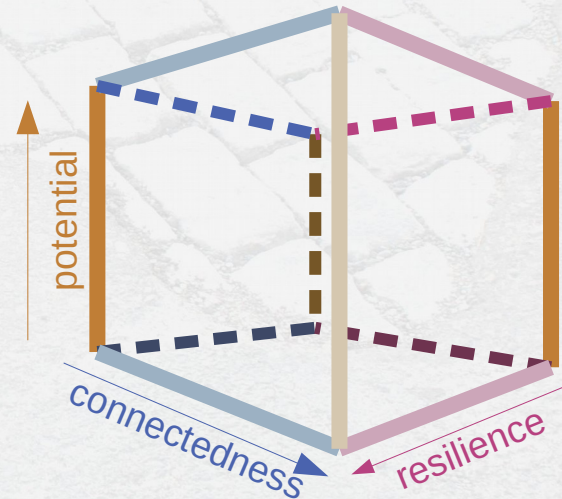
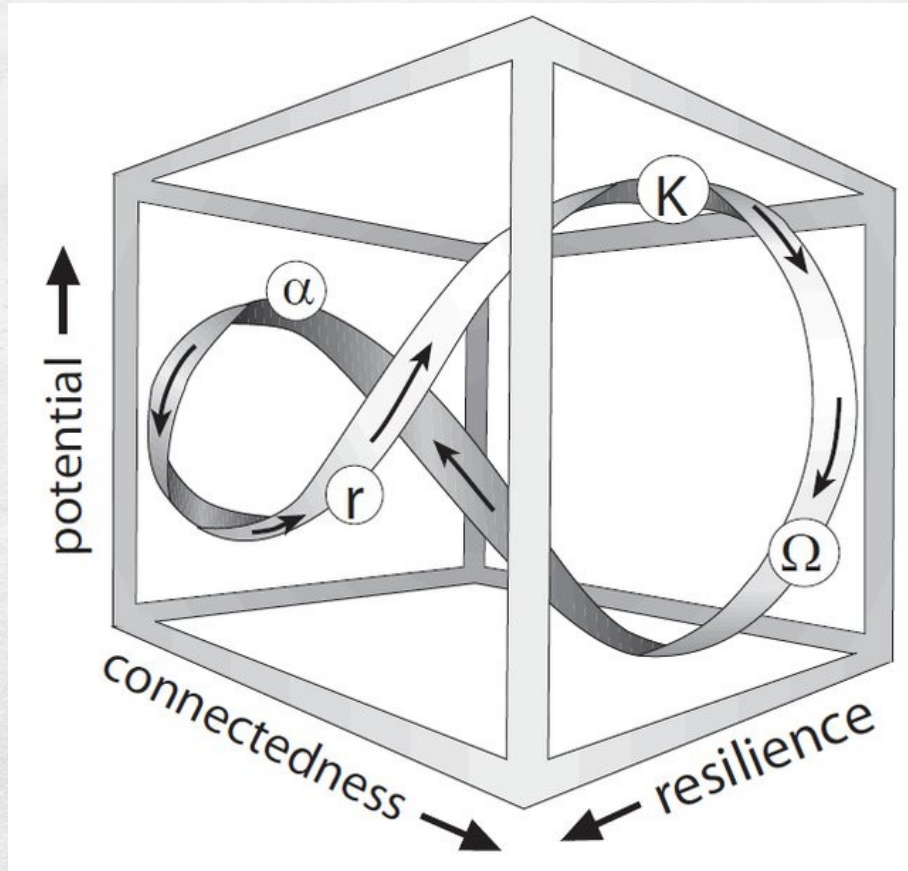


Figure 4. A stylized representation of the four ecosystem functions ( $r$ ,  $K$ ,  $\Omega$ ,  $\alpha$ ) and the flow of events among them.

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>.



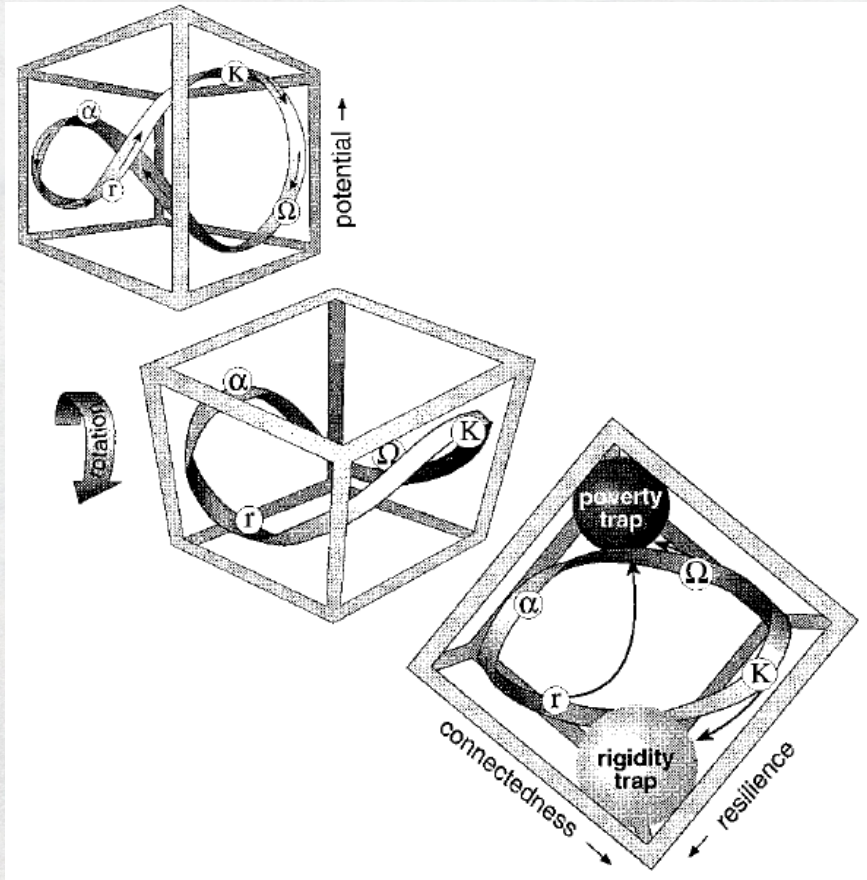
# Resilience is a third dimensions of change in the adaptive cycle



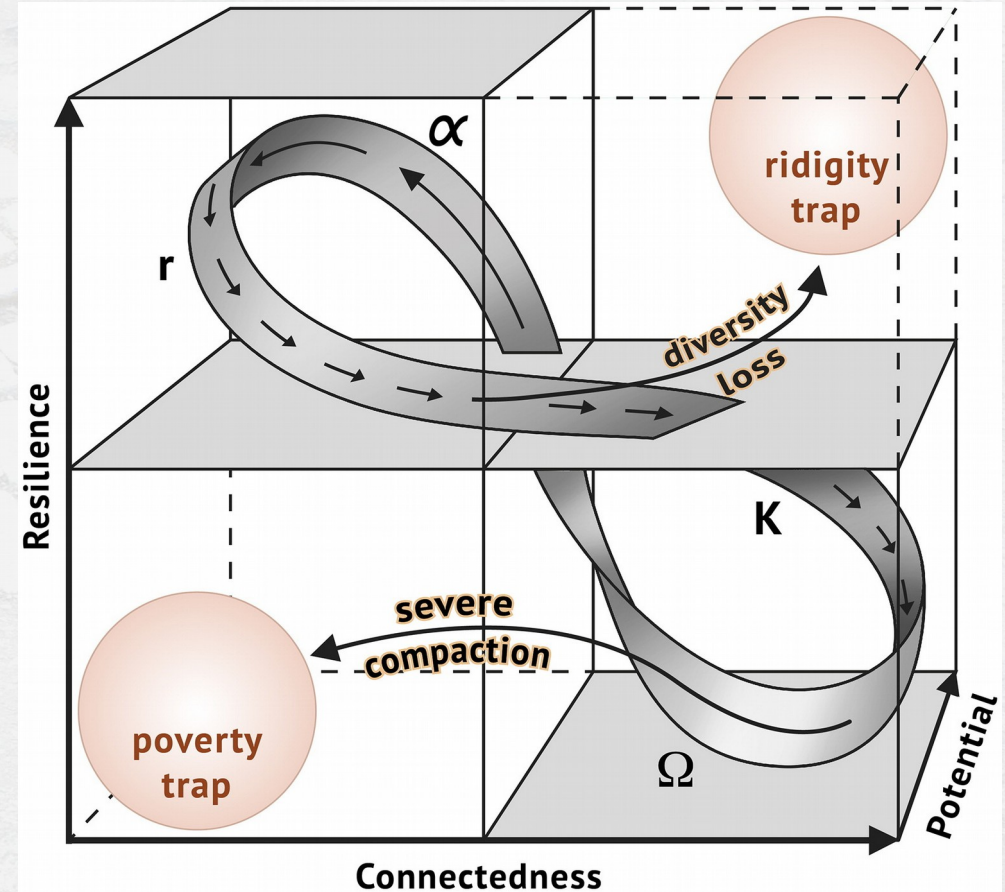
Neff, Brian P. 2013. "Traps and Transformations of Grenadian Water Management." Ph.D. dissertation, University of Waterloo. <http://hdl.handle.net/10012/8018>, modified from Gunderson & Holling 2002.



# Maladaptation departs the adaptive cycle as rigidity or poverty trap



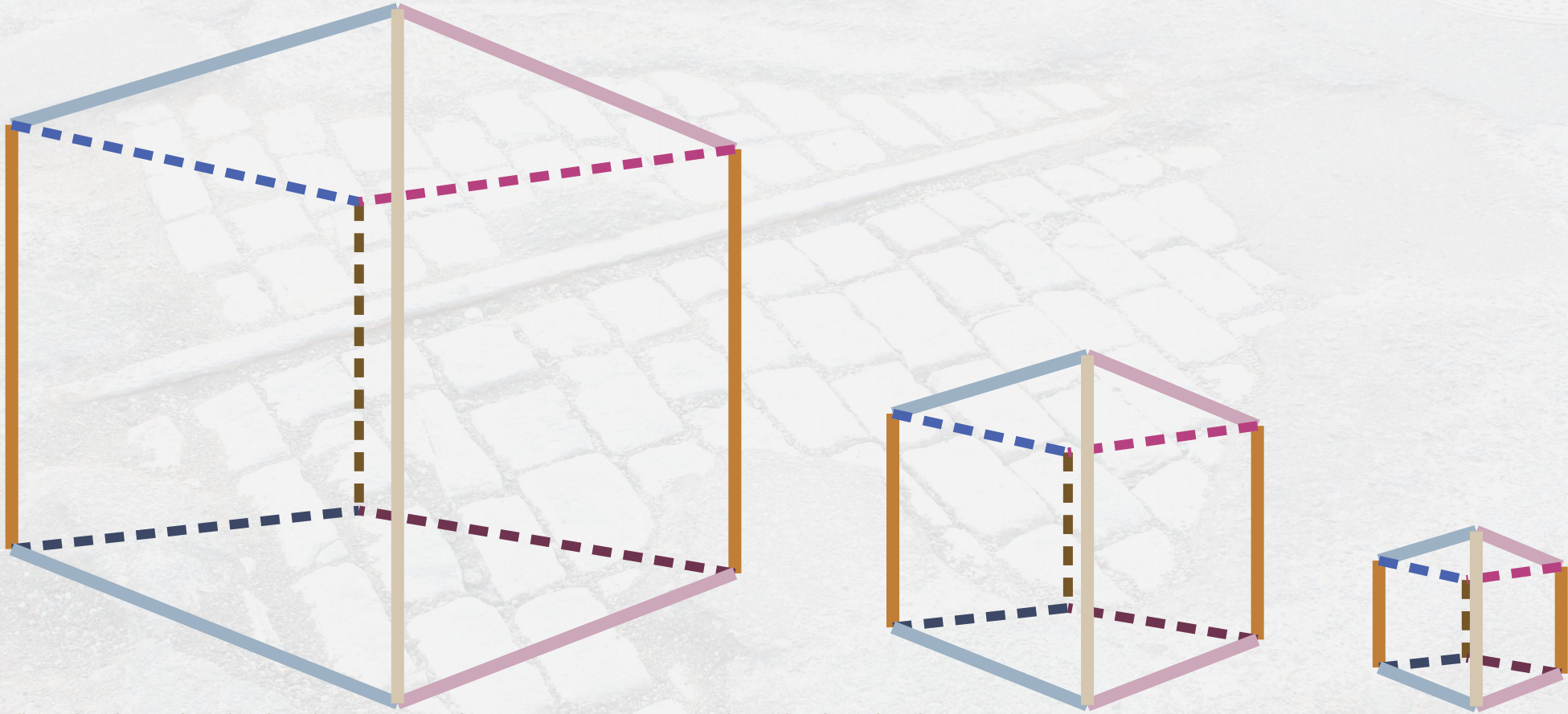
Holling, C. S. 2001. "Understanding the Complexity of Economic, Ecological, and Social Systems." *Ecosystems* 4 (5): 390–405. <https://doi.org/10.1007/s10021-001-0101-5>.



Ludwig, Marie, Paul Wilmes, and Stefan Schrader. 2018. "Measuring Soil Sustainability via Soil Resilience." *Science of The Total Environment* 626 (June): 1484–93. <https://doi.org/10.1016/j.scitotenv.2017.10.043>.



# With hierarchy theory, holons have simultaneous wholeness and partness



Allen, Timothy, and Mario Giampietro. 2014. "Holons, Creations, Genons, Environs, in Hierarchy Theory: Where We Have Gone." *Ecological Modelling*, Systems Ecology: A Network Perspective and Retrospective, 293 (December): 31–41. <https://doi.org/10.1016/j.ecolmodel.2014.06.017>.



# Panarchy crosses scales as larger-slower and smaller-faster relations

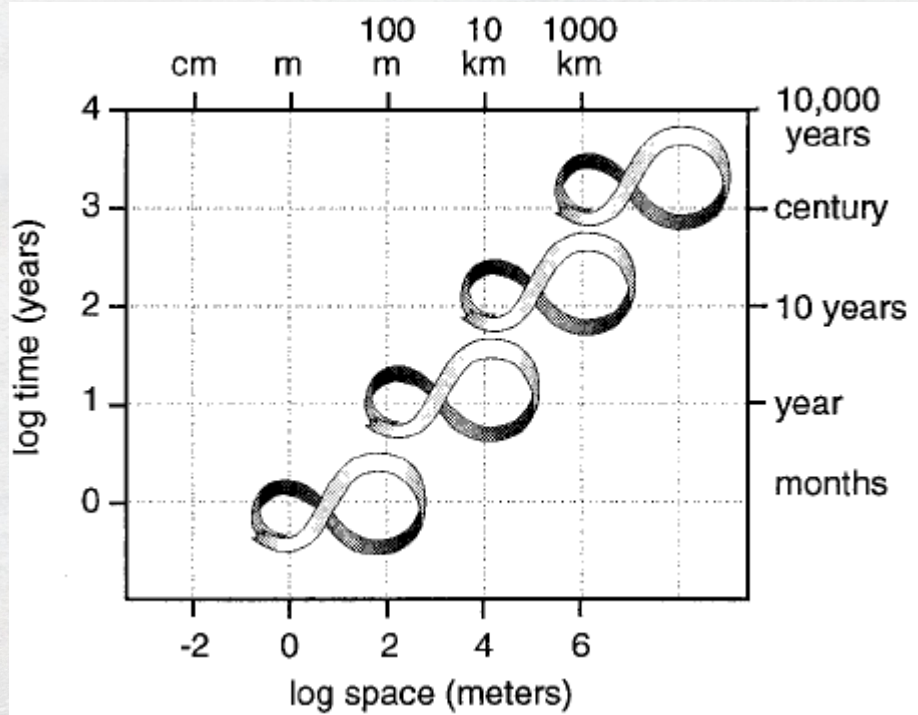


Figure 6. A stylized panarchy. A panarchy is a cross scale, nested set of adaptive cycles that indicates the dynamic nature of structures depicted in the previous plots.

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

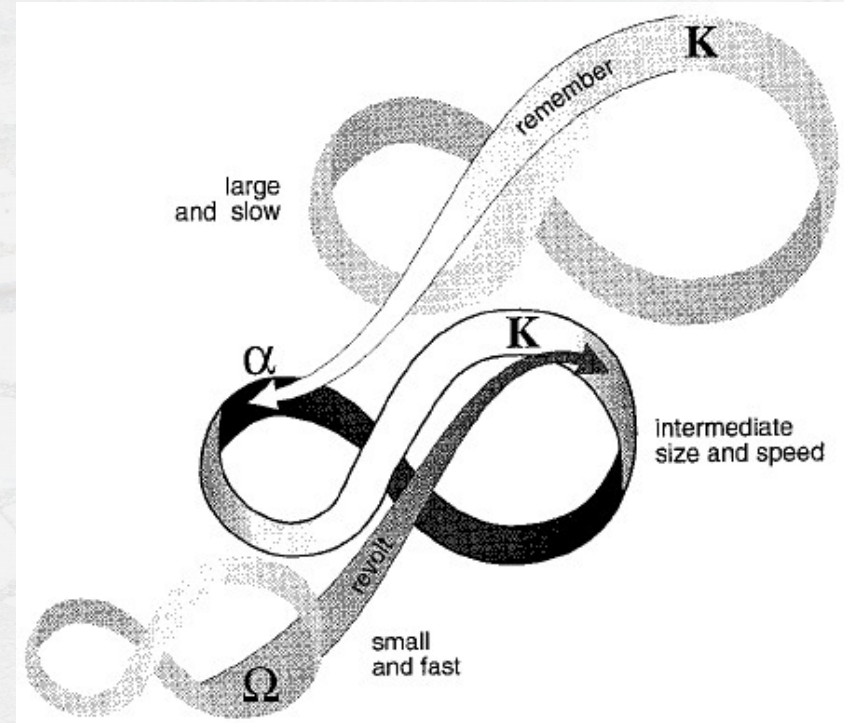


Figure 7. Panarchical connections. [...] the “revolt” connection ...can cause a critical change in one cycle to cascade up to a vulnerable stage in a larger and slower one. The ... “remember” connection ... facilitates renewal by drawing on the potential that has been accumulated and stored in a larger,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



# Changing scales (de-)complexifies or (de-)complicates

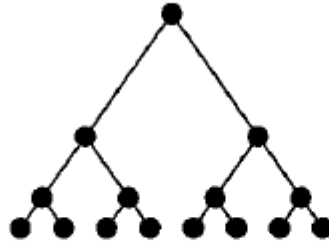
## Complexity

Elaboration of organization

Behavior gets simpler

Hierarchy gets deeper

- Hierarchical complexity
- Spectral complexity
- Elaboration across scales
- Increased certainty from samples



## Complicatedness

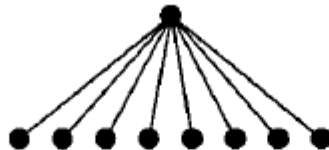
Elaboration of structure

Behavior gets more complicated

Hierarchy gets flatter

More degrees of freedom

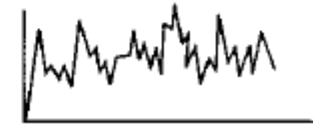
- Diversity
- Graph theoretic connectedness
- Information theory–Uncertainty



## Behavior

Becomes more elaborate  
e.g. Chaotic or Random

- Algorithmic complexity

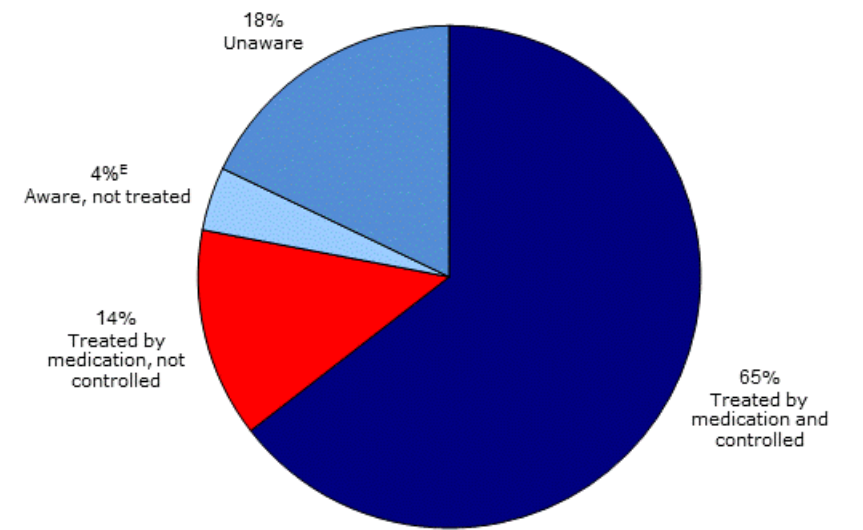


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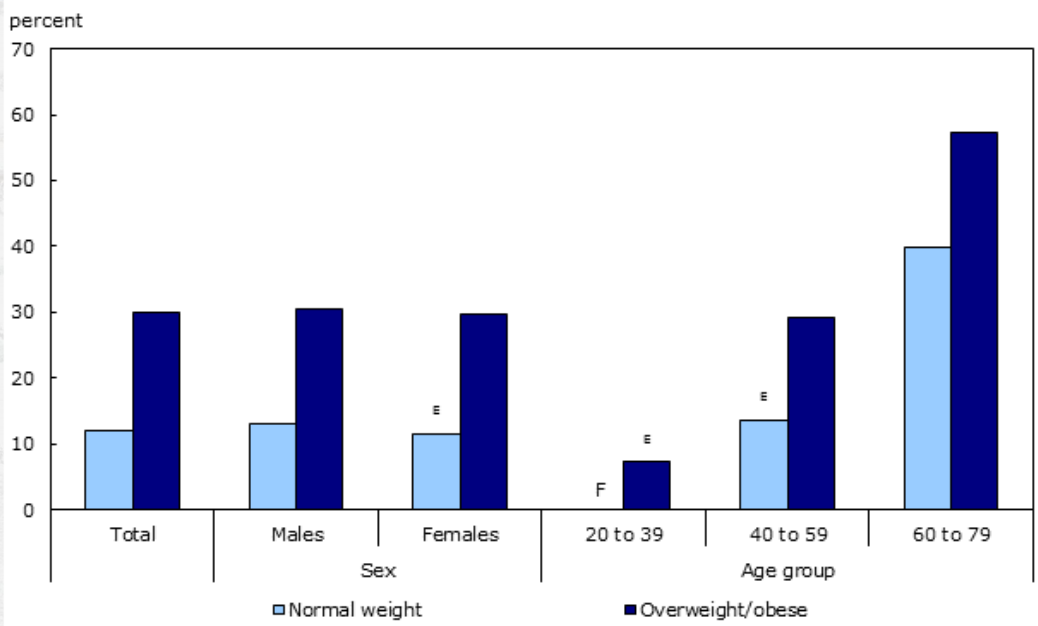
# Blood pressure of adults, 2012 to 2015 (Statistics Canada)

**Chart 2**  
Percentage of adults aged 20 to 79 with hypertension who are aware of their condition, whose hypertension is treated by medication, whose hypertension is controlled, or who are unaware of their condition, household population, Canada, 2012 to 2015



<sup>E</sup> use with caution (data with a coefficient of variation (CV) from 16.6% to 33.3%)  
**Note:** "Controlled" refers to a measured resting blood pressure < 140/90 mmHg.  
**Source:** Canadian Health Measures Survey, Cycle 3 (2012 and 2013) and Cycle 4 (2014 and 2015).

**Chart 3**  
Distribution of adults aged 20 to 79 with hypertension, by sex, age group and body mass index (BMI), household population, Canada, 2012 to 2015



<sup>E</sup> use with caution (data with a coefficient of variation (CV) from 16.6% to 33.3%)  
<sup>F</sup> too unreliable to be published (data with a coefficient of variation (CV) greater than 33.3%; suppressed due to extreme sampling variability)  
**Note:** The body mass index (BMI) classification is based on the *Canadian Guidelines for Body Weight Classification in Adults* (Health Canada, 2003).  
**Source:** Canadian Health Measures Survey, Cycle 3 (2012 and 2013) and Cycle 4 (2014 and 2015).



# Hypertension Prevention and Treatment Guidelines

## I. Health Behaviour Management

### Guidelines

- A. Physical exercise
- B. Weight reduction
- C. Alcohol consumption
- D. Diet
- E. Sodium intake
- F. Calcium and magnesium intake
- G. Potassium intake
- H. Stress management

## III. Choice of therapy for adults with hypertension without compelling indications for specific agents

### A. Indications for drug therapy for adults with diastolic and/or systolic hypertension

- 1. Initial therapy should be with either monotherapy or a single pill combination (SPC).
  - i. Recommended monotherapy choices are:
    - a. a thiazide/thiazide-like diuretic (Grade A), with longer-acting diuretics preferred (Grade B)
    - b. a  $\beta$ -blocker (in patients younger than 60 years; Grade B),
    - c. an angiotensin converting enzyme (ACE) inhibitor (in non-black patients; Grade B),
    - d. an angiotensin receptor blocker (ARB) (Grade B), or
    - e. a long-acting calcium channel blocker (CCB) (Grade B).
  - i. Recommended SPC choices are those in which an ACE inhibitor is combined with a CCB (Grade A), ARB with a CCB (Grade B), or ACE inhibitor or ARB with a diuretic (Grade B).
  - ii. Hypokalemia should be avoided in patients treated with thiazide/thiazide-like diuretic monotherapy (Grade C).



# Syndromes of hypertension and treatments by Chinese herbal formulas

	Clinical signs		Classical formula
	Vertigo, headache, facial flushing with perspiration, conjunctival congestion, bitter taste in the mouth, thirst, irritability and restlessness, wiry-rapid-powerful pulse or powerful cunkou pulse alone, or wiry and long pulse even well beyond the cunkou pulse		Tianma Gouteng decoction, Zhengan Xifeng decoction, Jianling decoction, and Longdan Xiegan decoction
	Facial flushing with perspiration, bitter taste in the mouth, thirst, insomnia, red tip of the tongue, and rapid pulse		Zhi-zi-chi decoction, Sanhuang Xiexin decoction, and Huanglian Jiedu decoction
	Dry mouth, thirst with desire for cold drinks, easy to starve, foul breath, abdominal distension and pain, smelly stool, constipation, red tongue, yellow dry fur, right guan pulse powerful alone, or strength and deep-hidden-powerful pulse		Da Chai Hu decoction, Baohe pill, Baihu decoction, Houpu Dahuang decoction, Gegen Qinlian decoction, and Zeng Ye decoction
	Obesity, dizziness, sticky mouth, thirst without a desire to drink, chest distress, nausea, vomiting, anorexia, abdominal distension, loose stools, sleepiness, greasy tongue coating, and slippery pulse		Erchen decoction, Pingwei powder, Wendan decoction, Banxia Baizhu Tianma decoction, and Xiao Xianxiong decoction
	Dizziness aggravated by change in body position, thirst without a desire to drink or not being thirsty, chest distress, palpitation, gastric distension, abdominal distension, poor appetite, lumbar heaviness, weakness and heaviness in the lower extremities, edema, daytime sleepiness, abnormal leucorrhea, dysuria, greasy fur, swollen tongue, and deep pulse		Banxia baizhu tianma decoction, Wuling powder, Zhuling decoction, Zexie decoction, and Fuling Guizhi Baizhu Gancao decoction
	Fatigue, shortness of breath, stomach pain, poor appetite, abdominal distension, and loose stools		Fuling Guizhi Baizhu Gancao decoction, Si jun Zi decoction, and Liu Jun Zi decoction
	Tiredness in the loins and legs, tinnitus and dizziness, sexual dysfunction, dysuria, weakness and fatigue, and weak chi pulse		Liuwei Dihuang pill and Shenqi pill

Wang, Jie, and Xingjiang Xiong. 2013. "Evidence-Based Chinese Medicine for Hypertension." *Evidence-Based Complementary and Alternative Medicine* <https://doi.org/10.1155/2013/978398>.





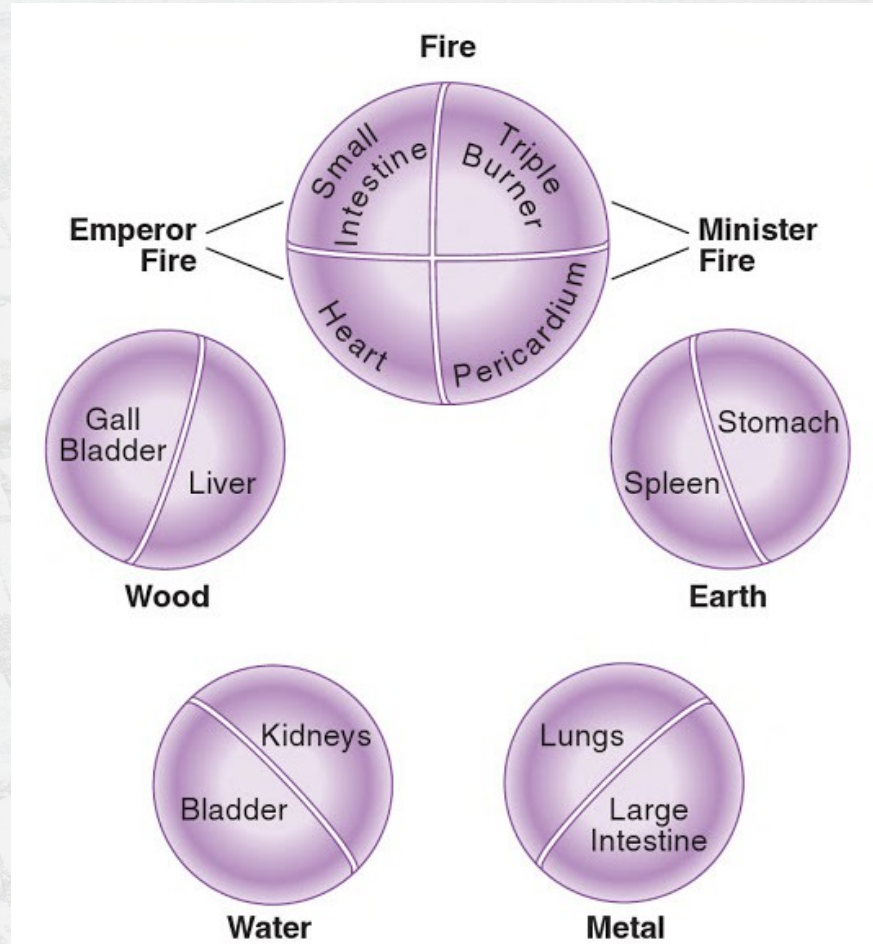
# Syndromes of hypertension and treatments by Chinese herbal formulas

Syndrome	Clinical signs	Treatment principles	Classical formula
<b>Fire syndrome</b>			
<b>Liver fire syndrome</b>	Vertigo, headache, facial flushing with perspiration, conjunctival congestion, bitter taste in the mouth, thirst, irritability and restlessness, wiry-rapid-powerful pulse or powerful cunkou pulse alone, or wiry and long pulse even well beyond the cunkou pulse	Calming liver and suppressing liver yang hyperactivity	Tianma Gouteng decoction, Zhengan Xifeng decoction, Jianling decoction, and Longdan Xiegan decoction
<b>Heart fire syndrome</b>	Facial flushing with perspiration, bitter taste in the mouth, thirst, insomnia, red tip of the tongue, and rapid pulse	Clearing heart fire	Zhi-zi-chi decoction, Sanhuang Xiexin decoction, and Huanglian Jiedu decoction
<b>Stomach fire syndrome and intestine fire syndrome</b>	Dry mouth, thirst with desire for cold drinks, easy to starve, foul breath, abdominal distension and pain, smelly stool, constipation, red tongue, yellow dry fur, right guan pulse powerful alone, or strength and deep-hidden-powerful pulse	Clearing stomach-intestine fire, promoting digestion, relaxing bowels, and relieving constipation	Da Chai Hu decoction, Baohe pill, Baihu decoction, Houpu Dahuang decoction, Gegen Qinlian decoction, and Zeng Ye decoction
<b>Phlegm-fluid retention syndrome</b>			
<b>Phlegm and dampness syndrome</b>	Obesity, dizziness, sticky mouth, thirst without a desire to drink, chest distress, nausea, vomiting, anorexia, abdominal distension, loose stools, sleepiness, greasy tongue coating, and slippery pulse	Dispelling phlegm and eliminating dampness	Erchen decoction, Pingwei powder, Wendan decoction, Banxia Baizhu Tianma decoction, and Xiao Xianxiong decoction
<b>Fluid retention syndrome</b>	Dizziness aggravated by change in body position, thirst without a desire to drink or not being thirsty, chest distress, palpitation, gastric distension, abdominal distension, poor appetite, lumbar heaviness, weakness and heaviness in the lower extremities, edema, daytime sleepiness, abnormal leucorrhea, dysuria, greasy fur, swollen tongue, and deep pulse	Dissipating excessive fluid	Banxia baizhu tianma decoction, Wuling powder, Zhuling decoction, Zexie decoction, and Fuling Guizhi Baizhu Gancao decoction
<b>Deficiency syndrome</b>			
<b>Spleen deficiency syndrome</b>	Fatigue, shortness of breath, stomach pain, poor appetite, abdominal distension, and loose stools	Reinforcing spleen	Fuling Guizhi Baizhu Gancao decoction, Si jun Zi decoction, and Liu Jun Zi decoction
<b>Kidney deficiency syndrome</b>	Tiredness in the loins and legs, tinnitus and dizziness, sexual dysfunction, dysuria, weakness and fatigue, and weak chi pulse	Reinforcing kidney	Liuwei Dihuang pill and Shenqi pill

Wang, Jie, and Xingjiang Xiong. 2013. "Evidence-Based Chinese Medicine for Hypertension." *Evidence-Based Complementary and Alternative Medicine* <https://doi.org/10.1155/2013/978398>.

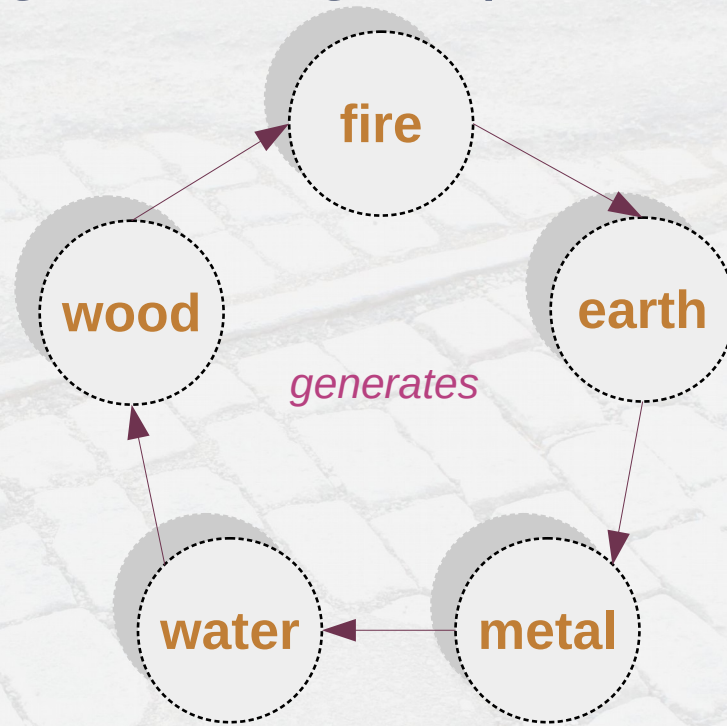


# Chinese medicine: the internal organs and five elements



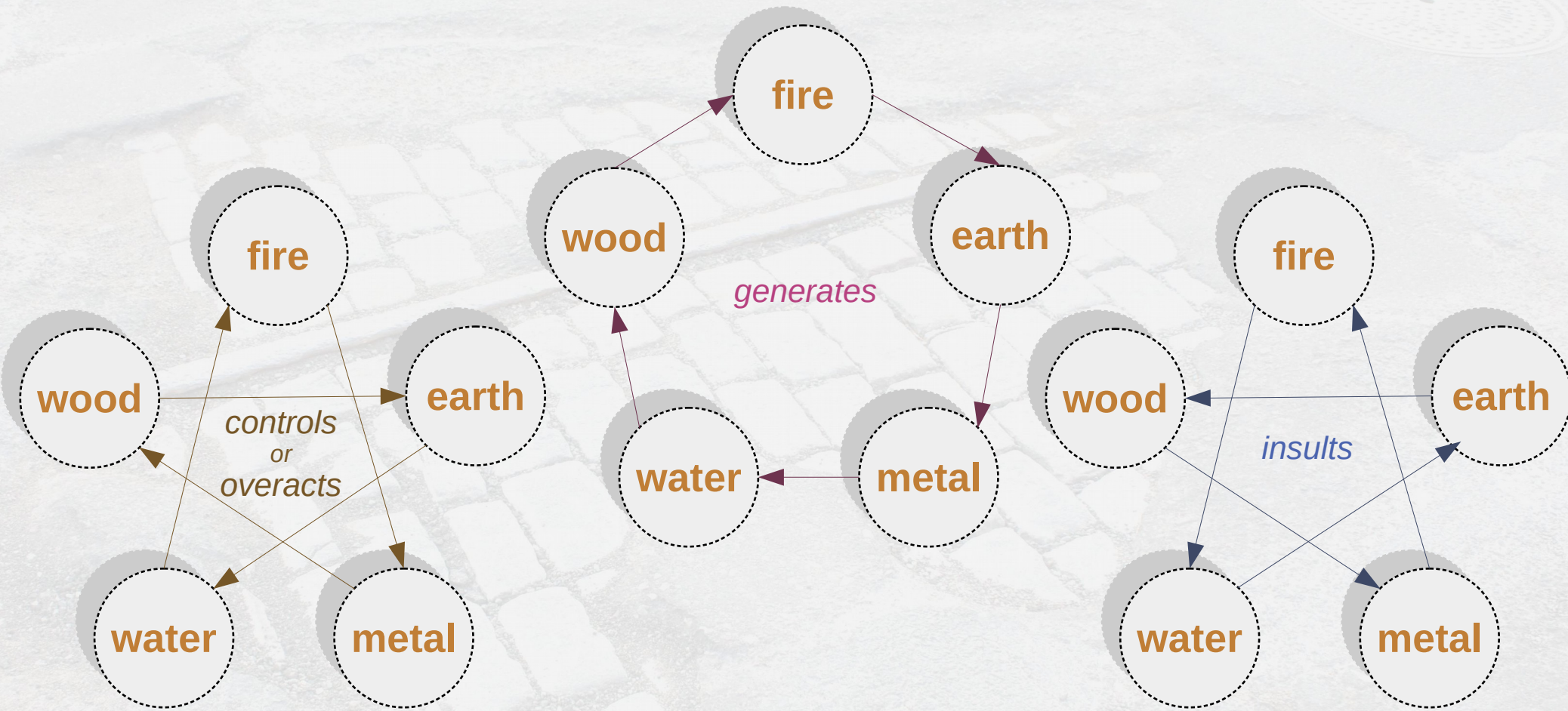


# Five elements: the generating sequence



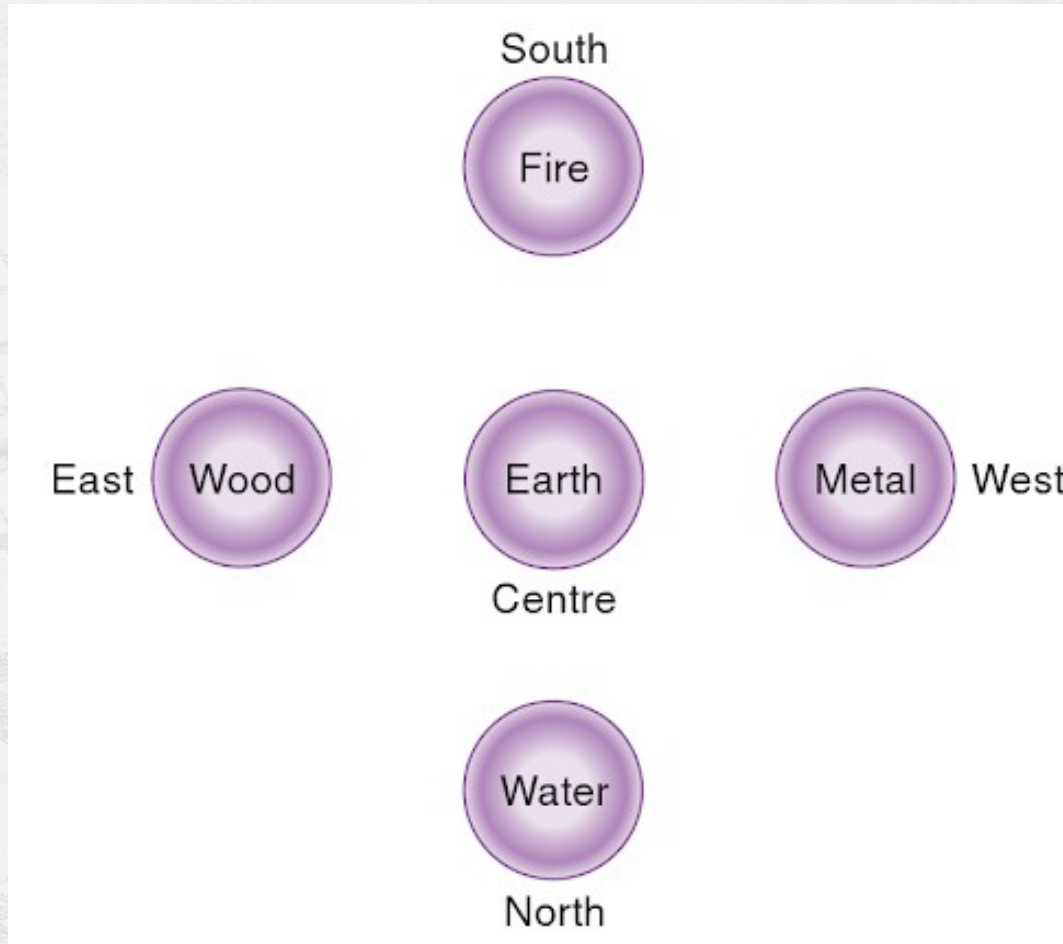


# Sequences: generating; controlling or overacting; insulting





# The five elements and cardinal directions





# Agenda

[preamble] Systems Changes and Action

A. (Human) Errors + (Systems) Breakdowns

B. Systems Approaches: Behavioral + Ecological

C. Action Learning + Pattern Sequences

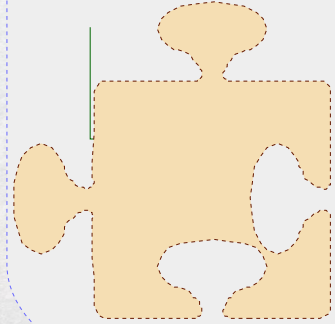
[postscript] Multi-Paradigm Inquiry



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

containing whole

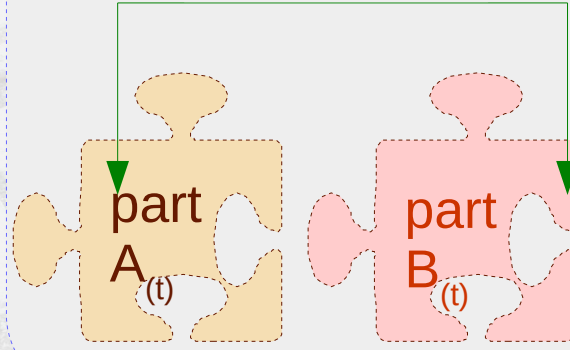
*Function* (non-living)  
*or role* (living)



**Function**

“contribution of the part to the whole”

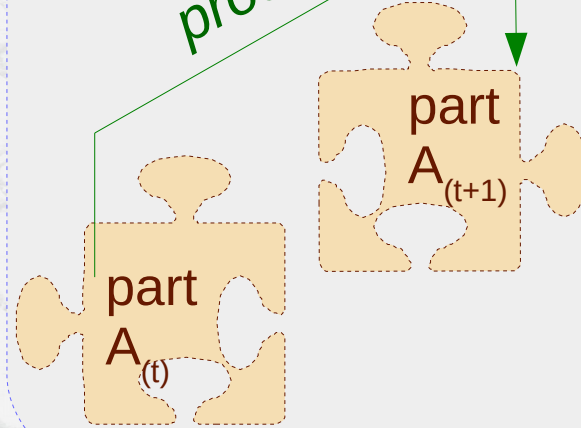
*structure*



**Structure**

“arrangement in space”

*process*



**Process**

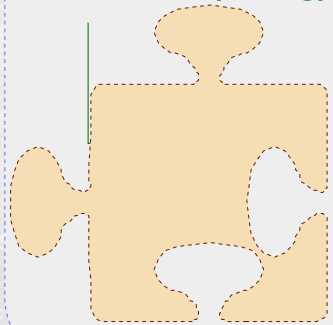
“arrangement in time”



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

containing  
whole

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



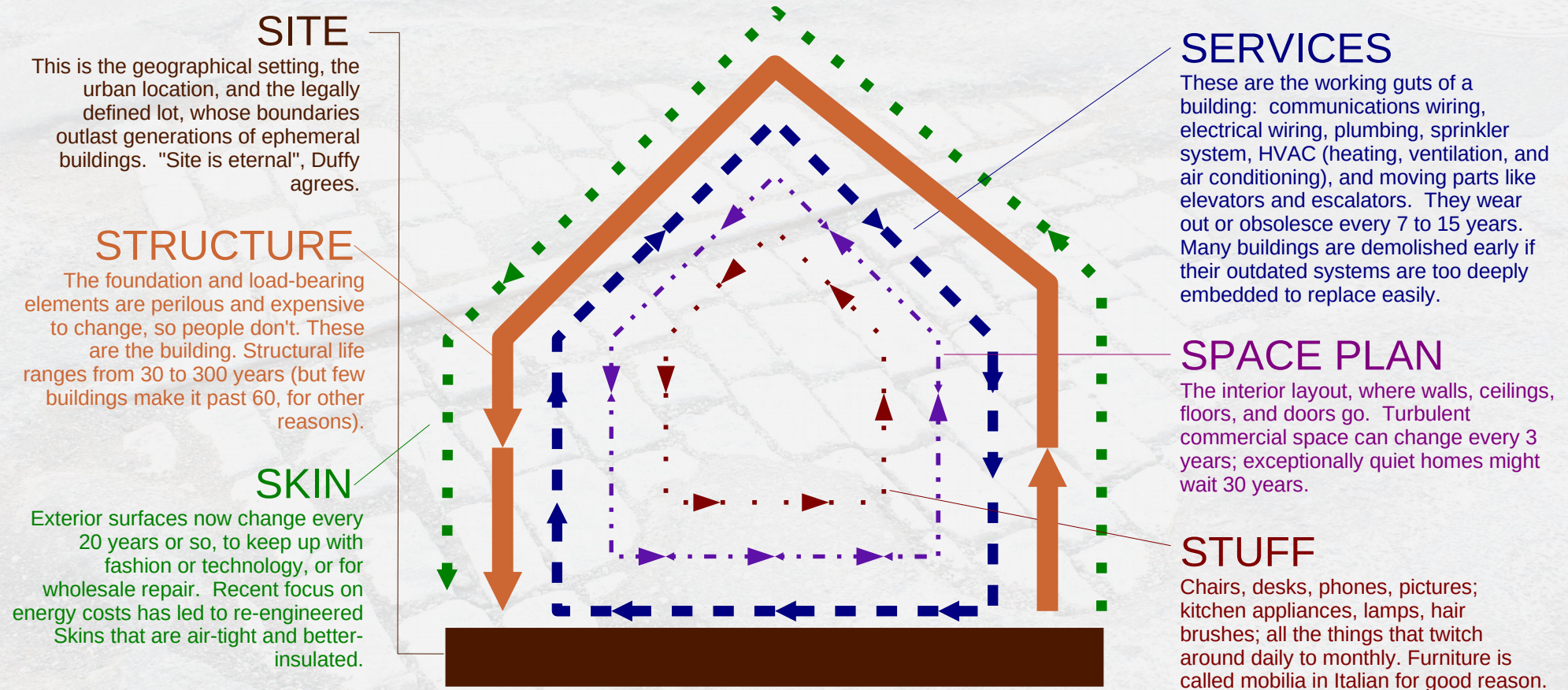
## Synthesis precedes analysis

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.



# Pacing layers emphasize coevolution and learning

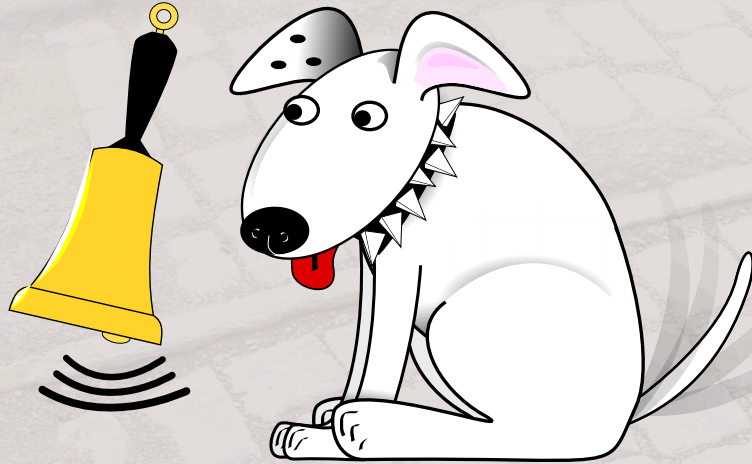


Source: Stewart Brand. 1994. *How Buildings Learn: What Happens after They're Built*. New York: Viking.



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

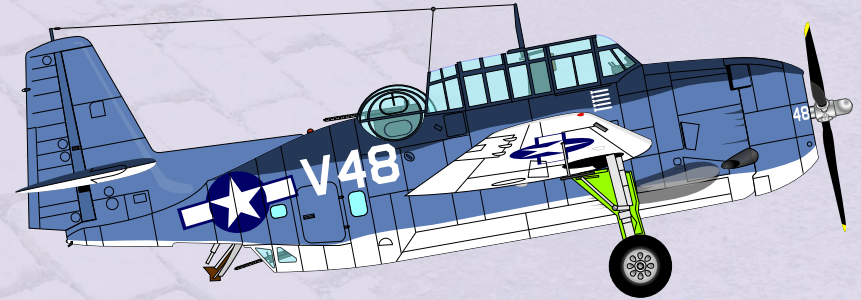
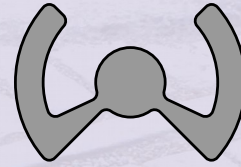
## Stimulus – Response (Behavioral Psychology)



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

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 often points to as radical features ....



# The Tavistock Institute developed three systems perspectives

[... the] socio-psychological, the socio-technical and the socio-ecological perspectives ... emerged from each other in relation to changes taking place in the wider social environment. One could not have been forecast from the others. Though **interdependent**, each has its own focus. Many of the **more complex projects require all three perspectives**. [p. 30]

## Socio-Psychological Systems Perspective

... in Institute projects, the **psychological forces** are directed **towards the social field**, whereas in the the Clinic, it is the other way around [with **social forces** directed **toward the psychological field**].  
[p. 31]

## Socio-Technical Systems Perspective

... the **best match** between the **social** and **technical systems** of an organization, since called the **principle of joint optimization**  
  
... the **second design principle**, the **redundancy of functions**, as contrasted with the **redundancy of parts**.  
[p. 32]

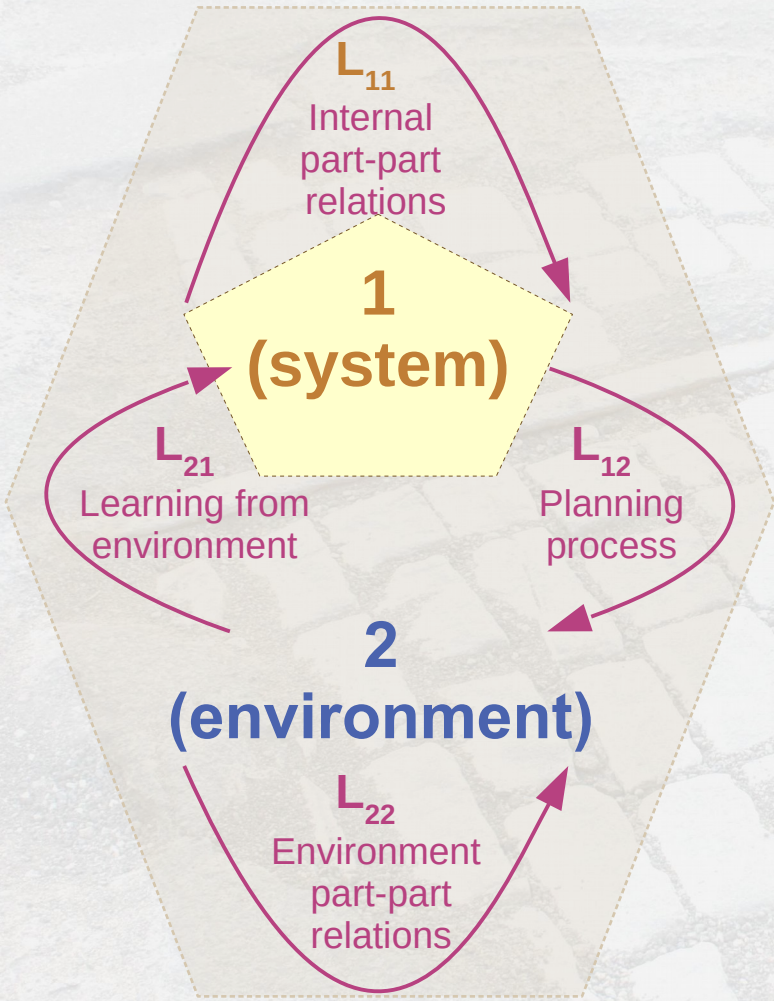
## Socio-Ecological Systems Perspective

... the **context** of the **increasing levels of interdependence, complexity and uncertainty** that characterize societies a the present time.  
  
... new problems related to **emergent values** such as **cooperation** and **nurturance**.  
[p. 33]

Trist, Eric L., and Hugh Murray. 1997. "Historical Overview: The Foundation and Development of the Tavistock Institute to 1989." In *The Social Engagement of Social Science: The Socio-Ecological Perspective*, edited by Eric L. Trist, Frederick Edmund Emery, and Hugh Murray, 3:1–35. Philadelphia: University of Pennsylvania Press.



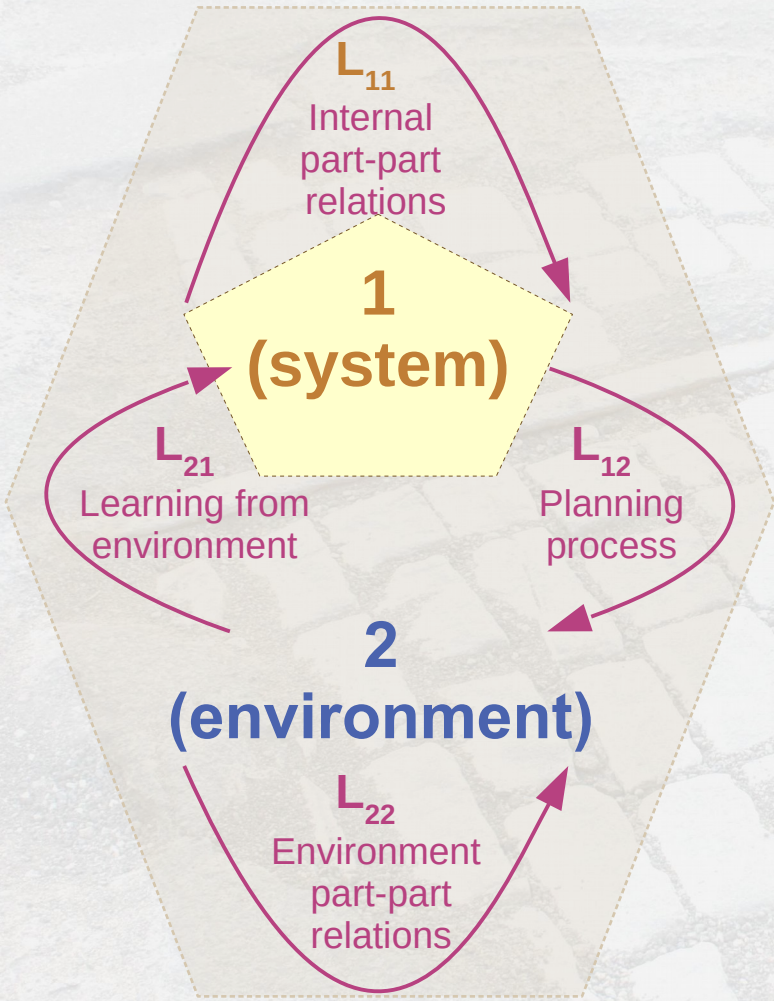
# Causal texture theory sees shifts in the field of system + environment



Source: Fred E. Emery, and Eric L. Trist. 1965. "The Causal Texture of Organizational Environments." Human Relations 18 (1) (February): 21–32.  
doi:10.1177/001872676501800103



# Causal texture theory sees shifts in the field of system + environment



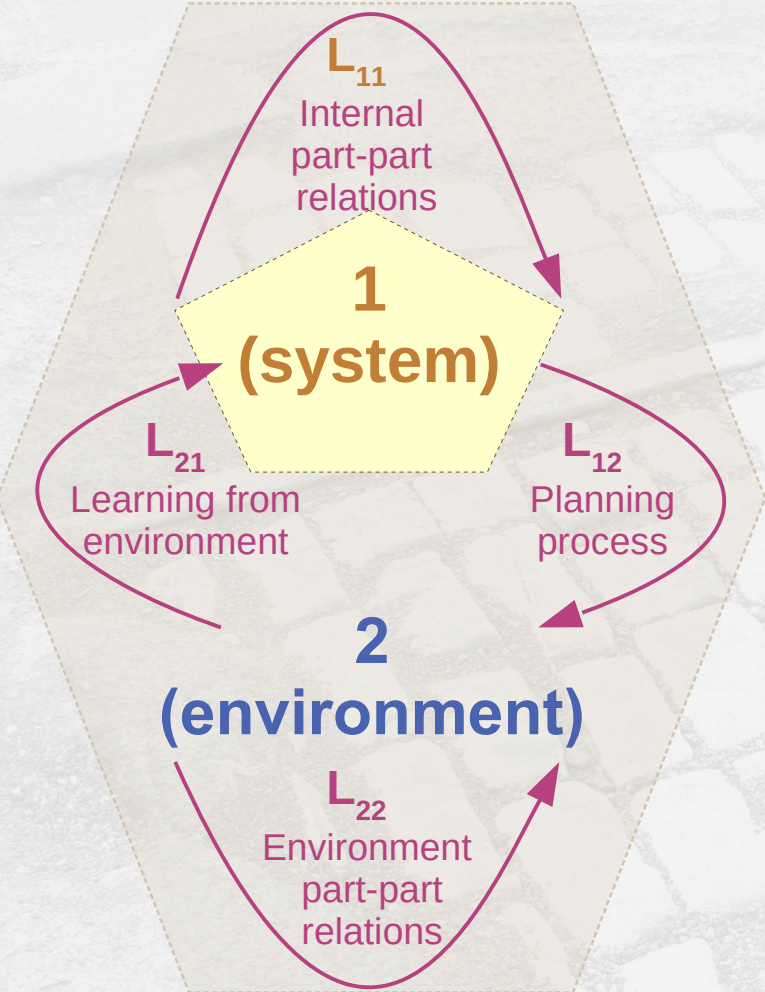
	Where O = goals (goodies), X = noxiants (baddes)	
Type I. Random Placid		Goals and noxiants randomly distributed. Strategy is tactical. "Grab it if it's there". Largely theoretical of micro, design, e.g. concentration camps, conditioning experiments. Nature is not random.



Source: Fred E. Emery, and Eric L. Trist. 1965. "The Causal Texture of Organizational Environments." Human Relations 18 (1) (February): 21–32.  
doi:10.1177/001872676501800103



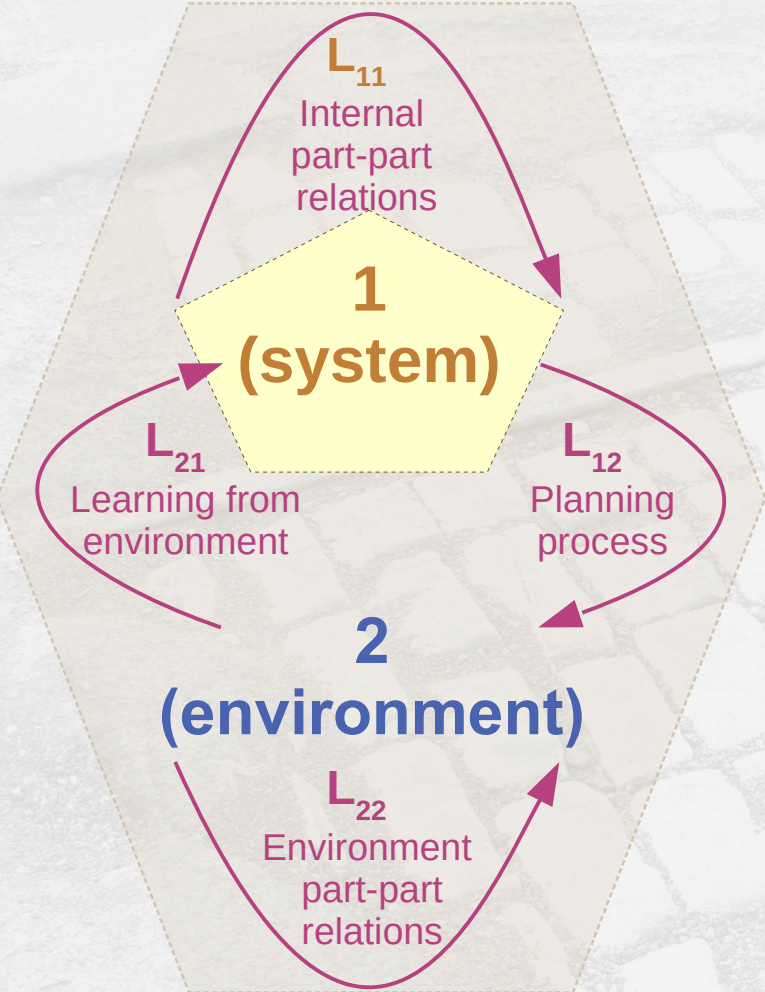
# Causal texture theory sees shifts in the field of system + environment



	Where O = goals (goodies), X = noxiants (baddes)	
Type 2. Clustered Placid		Goals and noxiants are lawfully distributed – meaningful learning. Simple strategy – maximize goals, e.g. use fire to produce new grass. Most of human span spent in this form. Hunting, gathering, small village. What people mean by the “good old days”.



# Causal texture theory sees shifts in the field of system + environment



	Where O = goals (goodies), X = noxiants (baddes)	
<b>Type 3. Disturbed Reactive</b>		Type 2 with two or more systems of one kind <i>competing</i> for the same resources. Operational planning emerges to out-manoeuvre the competition. Requires extra knowledge of both Ss and E. E is stable so start with a set of givens and concentrate on problem solving for win-lose games. Need to create instruments that are variety-reducing (foolproof) – elements must be standardized and interchangeable. Birth of bureacractic structures where people are redundant parts. Concentrate power at the top – strategy becomes a power game.



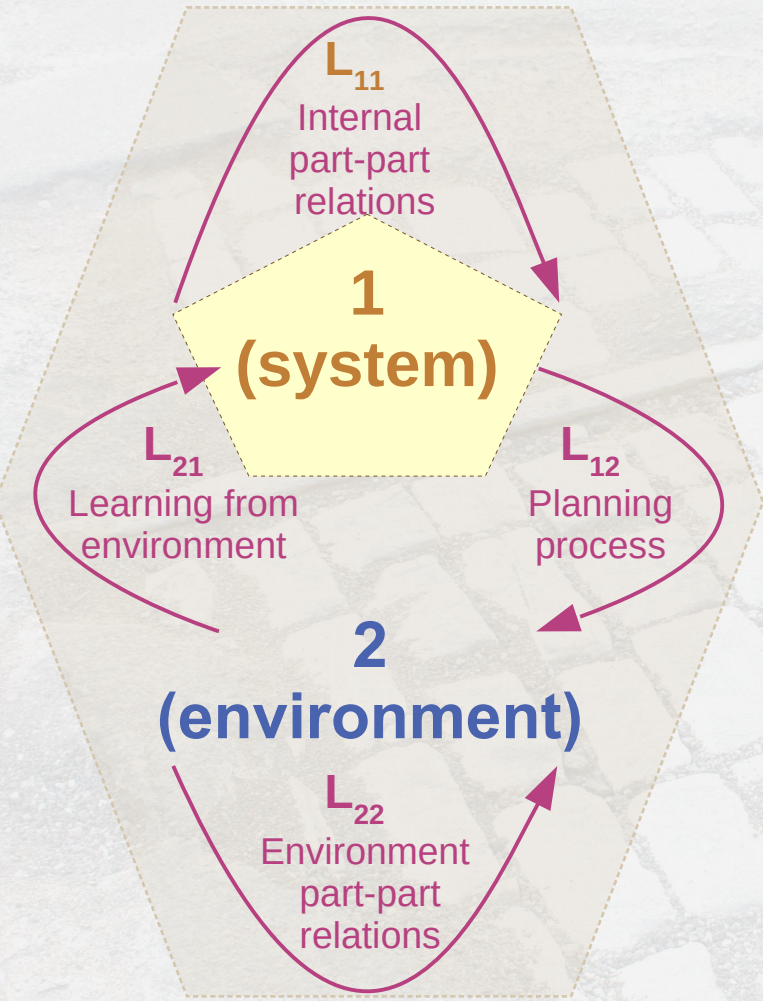
The diagram illustrates a two-level learning architecture. At the center is a yellow pentagon labeled **1 (system)**. Surrounding it is a larger, light-yellow hexagon labeled **2 (environment)**. Four curved arrows connect the system and environment levels, representing different learning processes:

- $L_{11}$  Internal part-part relations**: An arrow from the system to the environment.
- $L_{12}$  Planning process**: An arrow from the environment to the system.
- $L_{21}$  Learning from environment**: An arrow from the environment to the system.
- $L_{22}$  Environment part-part relations**: An arrow from the system to the environment.

Source: Fred E. Emery, and Eric L. Trist. 1965. "The Causal Texture of Organizational Environments." *Human Relations* 18 (1) (February): 21–32.  
doi:10.1177/001872676501800103



# Causal texture theory sees shifts in the field of system + environment

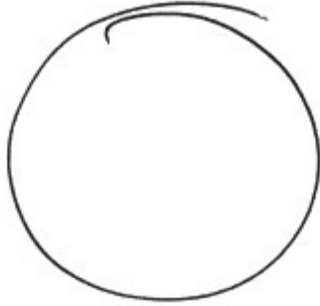


	Where O = goals (goodies), X = noxiants (baddes)	
Type 1. Random Placid		Goals and noxiants randomly distributed. Strategy is tactical. "Grab it if it's there". Largely theoretical of micro, design, e.g. concentration camps, conditioning experiments. Nature is not random.
Type 2. Clustered Placid		Goals and noxiants are lawfully distributed – meaningful learning. Simple strategy – maximize goals, e.g. use fire to produce new grass. Most of human span spent in this form. Hunting, gathering, small village. What people mean by the "good old days".
Type 3. Disturbed Reactive		Type 2 with two or more systems of one kind competing for the same resources. Operational planning emerges to out-manoeuvre the competition. Requires extra knowledge of both Ss and E. E is stable so start with a set of givens and concentrate on problem solving for win-lose games. Need to create instruments that are variety-reducing (foolproof) – elements must be standardized and interchangeable. Birth of bureaucratic structures where people are redundant parts. Concentrate power at the top – strategy becomes a power game.
Type 4. Turbulent		Dynamic, not placid/stable. Planned change in type 3 triggers off unexpected social processes. Dynamism arises from the field itself, creating unpredictability and increasing relevant uncertainty and its continuities. Linear planning impossible, e.g. whaling disrupted reproduction, people react to being treated as parts of machine. Birth of open systems thinking, ecology, and catastrophe theory.



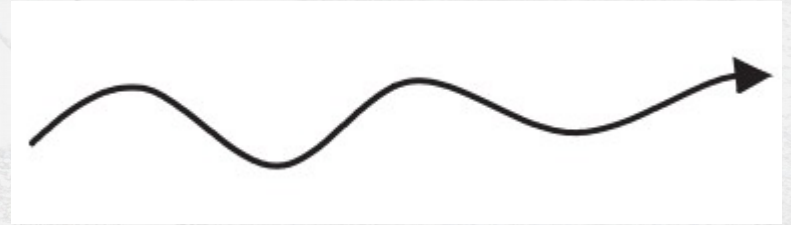


# How do we recognize a living system? As (a) the being of an organism; or (b) an animate becoming?



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’.

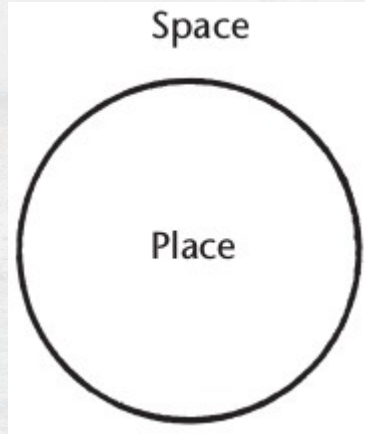
In this depiction there is no inside or outside, and no boundary separating the two domains. Rather there is a trail of movement or growth. Every such trail discloses a relation. But the relation is not between one thing and another – between the organism ‘here’ and the environment ‘there’. It is rather 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?



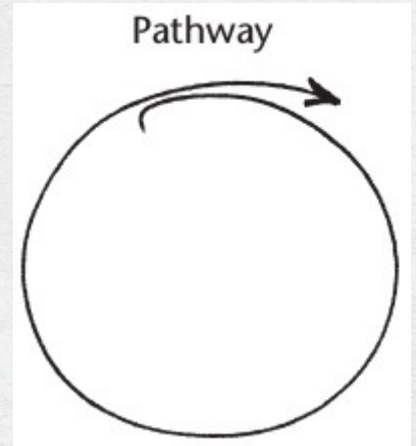
For the Inuit, as soon as a person moves he becomes a line.

... 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 ....

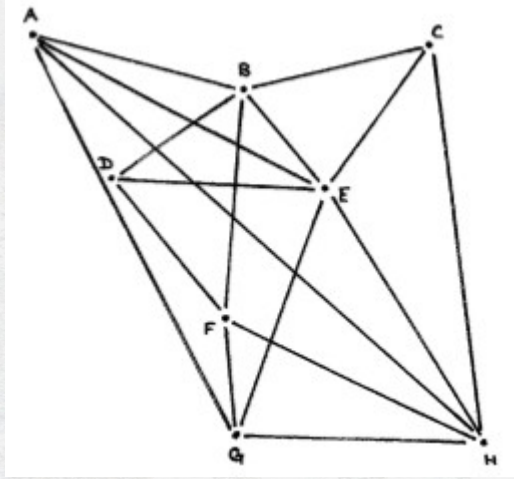
Human existence ... unfolds not in places but along paths. Proceeding along a path, every inhabitant lays a trail.



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

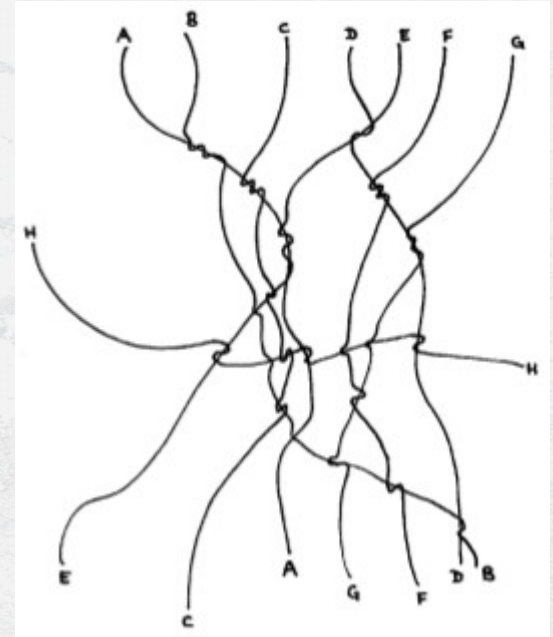


How are lives lived? As  
(a) a network of connected points; or (b) a meshwork of entangled lines?



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

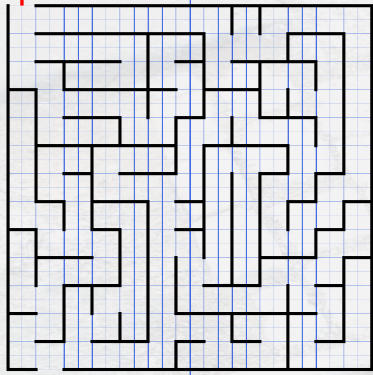
The lines of the meshwork are the trails *along* which life is lived.



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](https://issuu.com/stereographic/docs/walkon_for_issuu).



# Lifelines co-respond with habit, agencing, and attentionality



## Habit, rather than volition:

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

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

Images from Flickr: "Sandy walks on sunny evenings" CC-BY 2010 Satish Krishnamurthy; "Jump Together" CC-BY 2011 Stephanie Evanoff; "IMG 2012" CC-BY 2013 Ondrej Tachovsky



## Agencing, rather than agency:

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

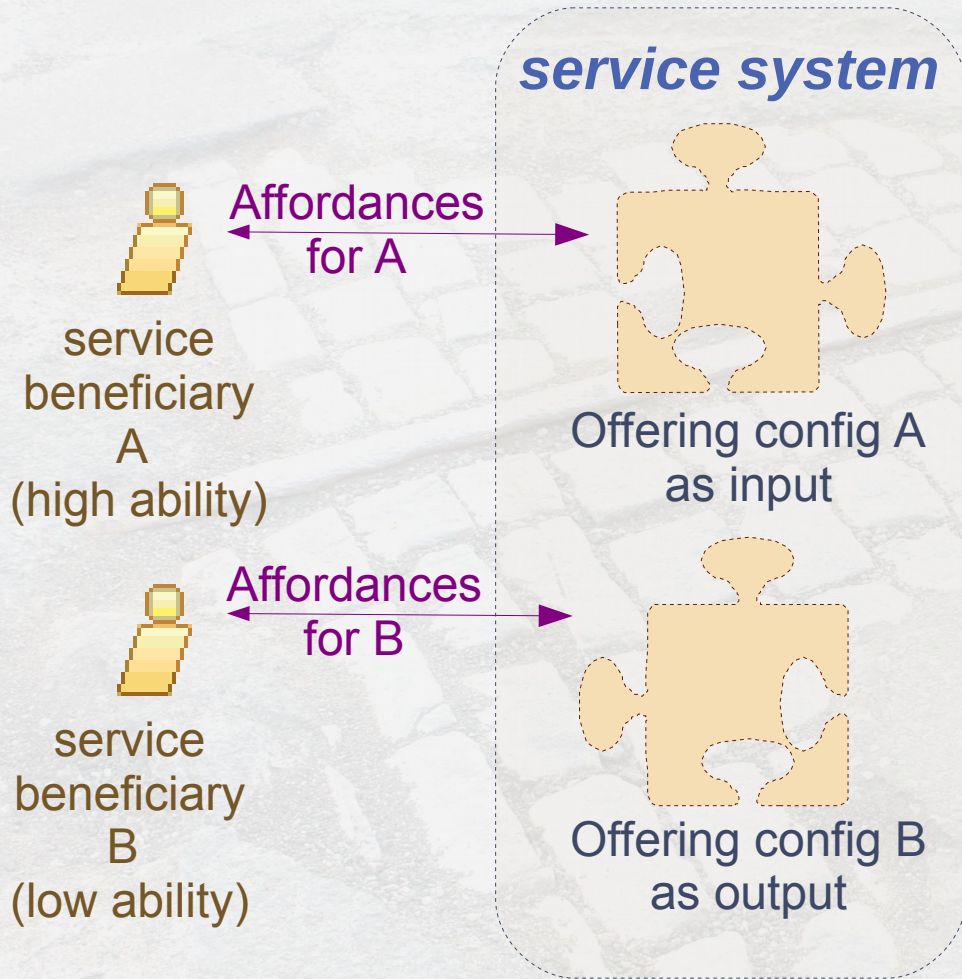


## Attentionality, rather than intentionality:

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



# 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.



# Agenda

[preamble] Systems Changes and Action

A. (Human) Errors + (Systems) Breakdowns

B. Systems Approaches: Behavioral + Ecological

C. Action Learning + Pattern Sequences

[postscript] Multi-Paradigm Inquiry



# Trito-learning rolls with turbulent contexts by negotiating in worlds where proto-learning and deuterio-learning break down

*Process discriminating  
context change over time*

*Example / metaphor  
(groups learn to cook)*

**Proto-  
learning  
(Learning 1)**

Change in response  
correcting errors within a  
set of alternatives

Training on food  
service handling for  
consistency and safety  
(e.g. cafeteria kitchens)

Bateson, Gregory. 1972. "The Logical Categories of Learning and Communication." In *Steps to an Ecology of Mind*, 279–308. Northvale, NJ: Jason Aronson



# Trito-learning rolls with turbulent contexts by negotiating in worlds where proto-learning and deuterio-learning break down

	<i>Process discriminating context change over time</i>	<i>Example / metaphor (groups learn to cook)</i>
<b>Deutero-learning</b> (Learning 2)	Change in response correcting the set of alternatives	Mastering a range of food prep traditions (e.g. Culinary Institute of America)
<b>Proto-learning</b> (Learning 1)	Change in response correcting errors within a set of alternatives	Training on food service handling for consistency and safety (e.g. cafeteria kitchens)

Bateson, Gregory. 1972. "The Logical Categories of Learning and Communication." In *Steps to an Ecology of Mind*, 279–308. Northvale, NJ: Jason Aronson



# Trito-learning rolls with turbulent contexts by negotiating in worlds where proto-learning and deutero-learning break down

	<i>Process discriminating context change over time</i>	<i>Example / metaphor (groups learn to cook)</i>
<b>Trito-learning</b> (Learning 3)	Change in response correcting for contexts (i.e. systems of sets of alternatives)	Competing on tv cooking challenges as teams and individuals (e.g. Hell's Kitchen)
<b>Deutero-learning</b> (Learning 2)	Change in response correcting the set of alternatives	Mastering a range of food prep traditions (e.g. Culinary Institute of America)
<b>Proto-learning</b> (Learning 1)	Change in response correcting errors within a set of alternatives	Training on food service handling for consistency and safety (e.g. cafeteria kitchens)

Bateson, Gregory. 1972. "The Logical Categories of Learning and Communication." In *Steps to an Ecology of Mind*, 279–308. Northvale, NJ: Jason Aronson



# Coevolving Innovations

... in Business Organizations and Information Technologies

## Christopher Alexander, Horst Rittel, C. West Churchman

At U.C. Berkeley in the 1960s, [Christopher Alexander](#), [Horst Rittel](#) and [C. West Churchman](#) could have had lunch together. While disciplinary thinking might lead novices to focus only on each of [pattern language](#), [wicked problems](#) and [the systems approach](#), there are ties (as well as domain-specific distinctions) between the schools.



Circa 1968-1970: Christopher Alexander, Horst Rittel, West Churchman

### Recent Posts

- [Christopher Alexander, Horst Rittel, C. West Churchman](#)
- [Open Innovation Learning and Open Data](#)
- [Learning data science, hands-on](#)
- [Innovation Learning and Open Sourcing: IoT + Cloud + Cognitive](#)
- [Acts of representation with systems thinking \(OCADU 2017/03\)](#)
- [Service Systems Thinking, with Generative Pattern Language \(Metropolia 2016/12\)](#)

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**David Ing**  
@daviding

Anshansicun: Whimsically residential area,... [bit.ly/2jU](#)





# At Berkeley: Churchman, Rittel and Alexander taught in 1960-1970s

## C. West Churchman (1913-2004)

- 1957 joined Berkeley, graduate programs in OR at School of Business Administration
- 1964-1970 Associate Director and Research Philosopher, Space Sciences Laboratory
- 1981-1994 retired, taught Peace & Conflict Studies

## Horst Rittel (1930-1990)

- 1963 Berkeley College of Environmental Design
- 1974 both Berkeley and University of Stuttgart

## Christopher Alexander (1936 - )

- 1963 Berkeley College of Environmental Design
- 1967 cofounder Center for Environmental Structure
- 1998 retired from university

Both Alexander and Rittel were part of what at the time was called the 'design methods' movement in architecture, worked and taught in the same building, and did talk and were seen walking off to have lunch together. Churchman was teaching in the Business School a few minutes down on the way to the center of campus.

- *Thor Mann*  
(posted April 17, 2017)



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:

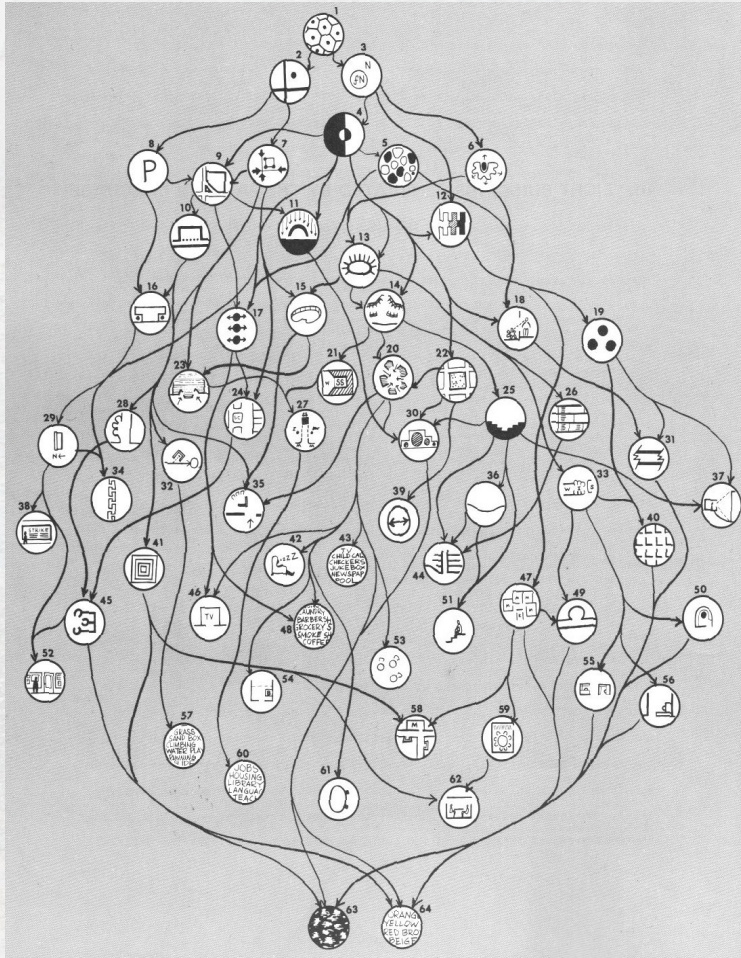
- Other solutions to the same problem,
- More general or (possibly domain) specific variations of the pattern,
- Patterns that solve some of the problems in the resulting context (set by this pattern)

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>



# 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).

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

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

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

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

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

Alexander, Christopher, Sara Ishikawa, and Murray Silverstein. 1967. *Pattern Manual*. Berkeley, California: Center for Environmental Structure



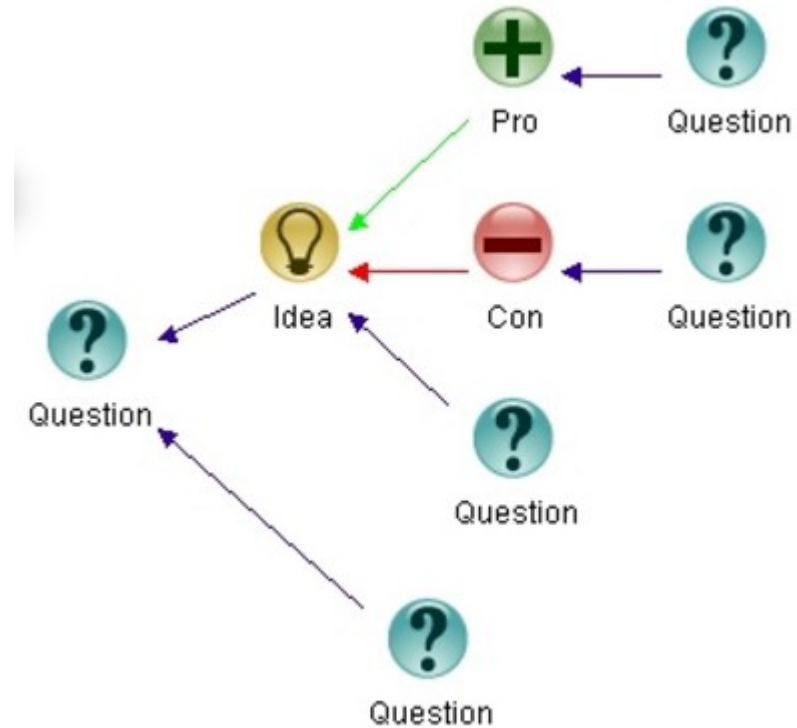
# “Dilemmas in a General Theory of Planning”, (Rittel + Weber, 1973)

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

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

# Wicked problems ↔ IBIS: Issues-Based Information Systems

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8. Every wicked problem can be considered to be a symptom of another problem.
9. The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem's resolution.
10. The social planner has no right to be wrong (i.e., planners are liable for the consequences of the actions they generate). (Rittel & Weber, 1973)



...type of information system meant to support the work of cooperatives like governmental or administrative agencies or committees, planning groups, etc., that are confronted with a problem complex in order to arrive at a plan for decision... (Kunz & Rittel, 1970)



# Excerpts from three sample patterns for Multi-Service Centers

(i) Pattern name (plus headline)	21. Self-service <b>The waiting area contains a self-service facility, where job listing, welfare rights information and other do-it-yourself services are open, without restriction, to the public.</b>	28. The intake position <b>Intake procedures are informally handled by field workers, in a lounge setting, near the major entrance.</b>	32. Child-care position <b>The child care station is visible along the path from the entrance to the services.</b>
(ii) Completions of larger patterns	14. Free waiting  ◇ ◇ ◇	7. Entrance locations 10. Open to street  ◇ ◇ ◇	7. Entrance locations 10. Open to street  ◇ ◇ ◇
(iii) Range of contexts (physical feature, set of conditions)	Any multi-service center.	A multi-service center with field workers (block workers, contact workers, community organisers, etc.)	A child care station in any building where mothers have prolonged business (multi-service center, supermarket, etc.)
(iv) Problem to be solved (system of forces that arises)	Most service programs today effectively perpetuate the structural asymmetry of the dole .... If service programs ever hope to break the chain of poverty, this structural asymmetry ... must be destroyed ....	Many existing centers create the feeling that people coming to the center are being processed, like cattle, by receptionists and intake workers. ... the "intake function" will be handled on an informal basis by community organisers and contact workers ...	When small children are left off at care centers they are often extremely anxious; they feel deserted ... ... create circumstances under which the child decides, of his own accord, that wants to play in the center.
(v) Solution (configuration of abstract spatial relational forces)	<b>1. The MSC contains a <i>self-service</i> area. 2. ... contains all of the basic information required by people who need help. 3. ... in both languages. 4. ... visible from all points in the waiting area. 5. ... contiguous ... with service area. 6. ... no receptionists or intake workers located at entrance ... 7. ... advice area contains at least one easily accessible assistant ...</b>  ◇ ◇ ◇	<b>... no formal intake process ... 1. ... field workers, in rotation ... in a conversation and interview area. 2. The intake area should be ... next to the main entrance(s) ... no receptionists. 3. ... should contain one or more open alcoves, at least 7 feet in diameter, and furnished with comfortable seats.</b>  ◇ ◇ ◇	<b>The child care station should be on the path from the building entrance to the place of business, and visible from this path; and ... it looks into the child care station for roughly 20 feet along its length.</b>  ◇ ◇ ◇
(vi) Completions to smaller patterns	27. Self-service progression	43. Sleeping OK	57. Child care contents



# Alexandrian format and pattern #32 for Multi-Service Centers

(i) Pattern name (plus headline)	32. Child-care position <b>The child care station is visible along the path from the entrance to the services.</b>
(ii) Completions of larger patterns	7. Entrance locations 10. Open to street  ◇ ◇ ◇
(iii) Range of contexts (physical feature, set of conditions)	A child care station in any building where mothers have prolonged business (multi-service center, supermarket, etc.)
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(vi) Completions to smaller patterns	57. Child care contents



# 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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# Pattern Manual for Service Systems Thinking: A proposal for discussion

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## 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 21<sup>st</sup> 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.

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



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## Publications

Submitted by davidng on Thu, 10/27/2016 - 22:31

Publication Date	Publication Title	Author(s)	Form
October 2016	"Pattern Manual for Service Systems Thinking: A proposal for discussion" <a href="#">[view abstract and article]</a>	David Ing	article in review for <a href="#">the 2016 International Conference</a>
October 2016	"Curriculum Making for Trito Learning: Wayfaring along a meshwork of systems thinking" <a href="#">[view abstract and presentation slides]</a>	David Ing	presentation at <a href="#">RSD5 Relating Systems Thinking Design</a>
	"Service Systems and the Systems Sciences"		presentation at <a href="#">Wuhan</a>

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## 2016/10/28 Pattern Manual for Service Systems Thinking

Submitted by davidng on Thu, 09/29/2016 - 21:00

### Authors

David Ing

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- [\[view/download article as PDF\]](#) (2.2 MB)

# *Pattern Manual* (1967): systems, subsystems, patterns

The environmental **pattern language** will contain **hundreds of subsystems** and **tens of thousands of individual patterns**.

Every conceivable kind of building, every part of every kind of building, and every piece of the larger environment will be specified by one or more subsystems of the environmental pattern language.

In summary:

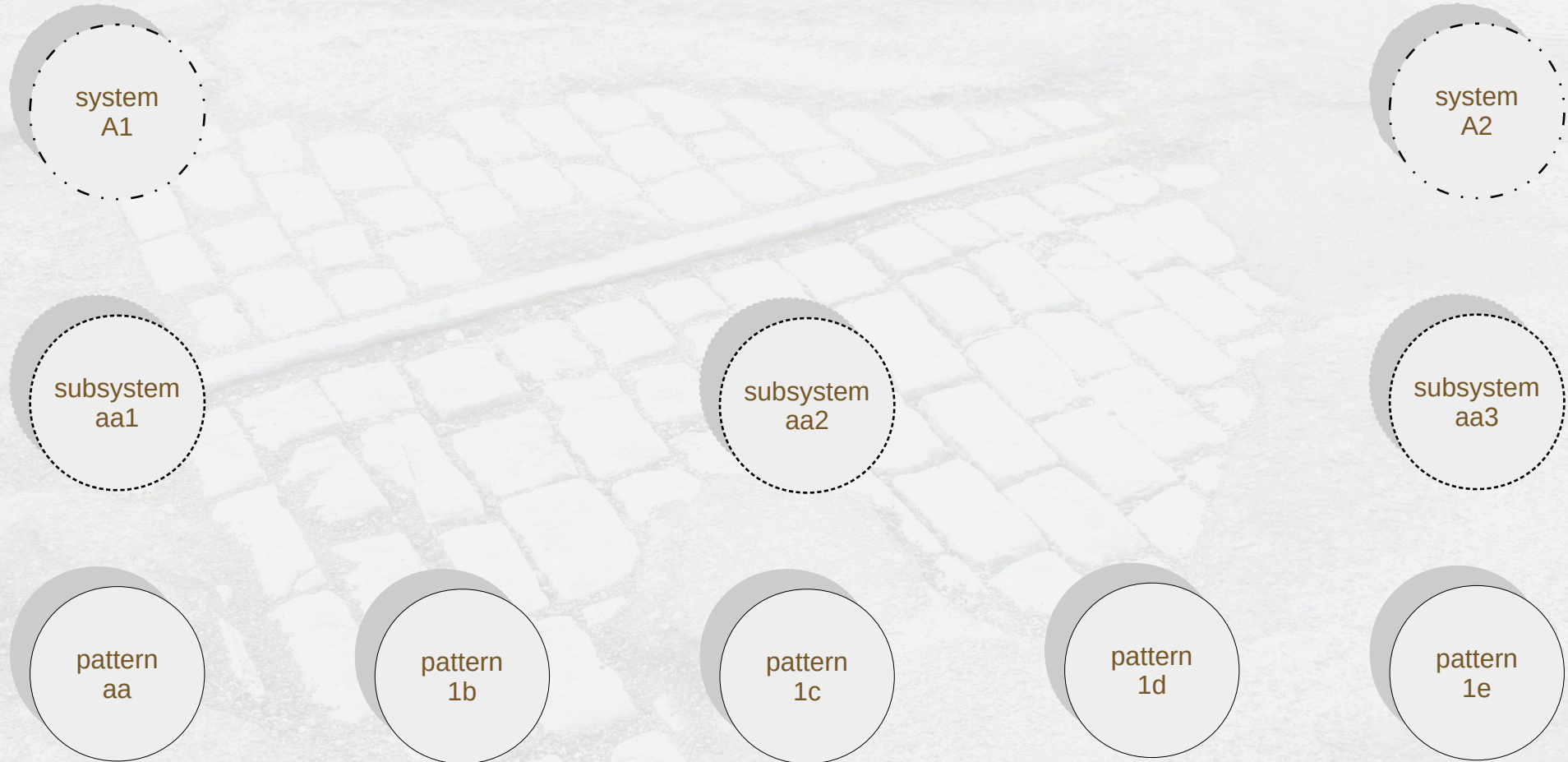
An environmental pattern language is a coordinated body of **design solutions** capable of **generating** the complete **physical structure** of a city.

The language is designed to **grow and improve continuously** as a result of criticism and feedback from the field.

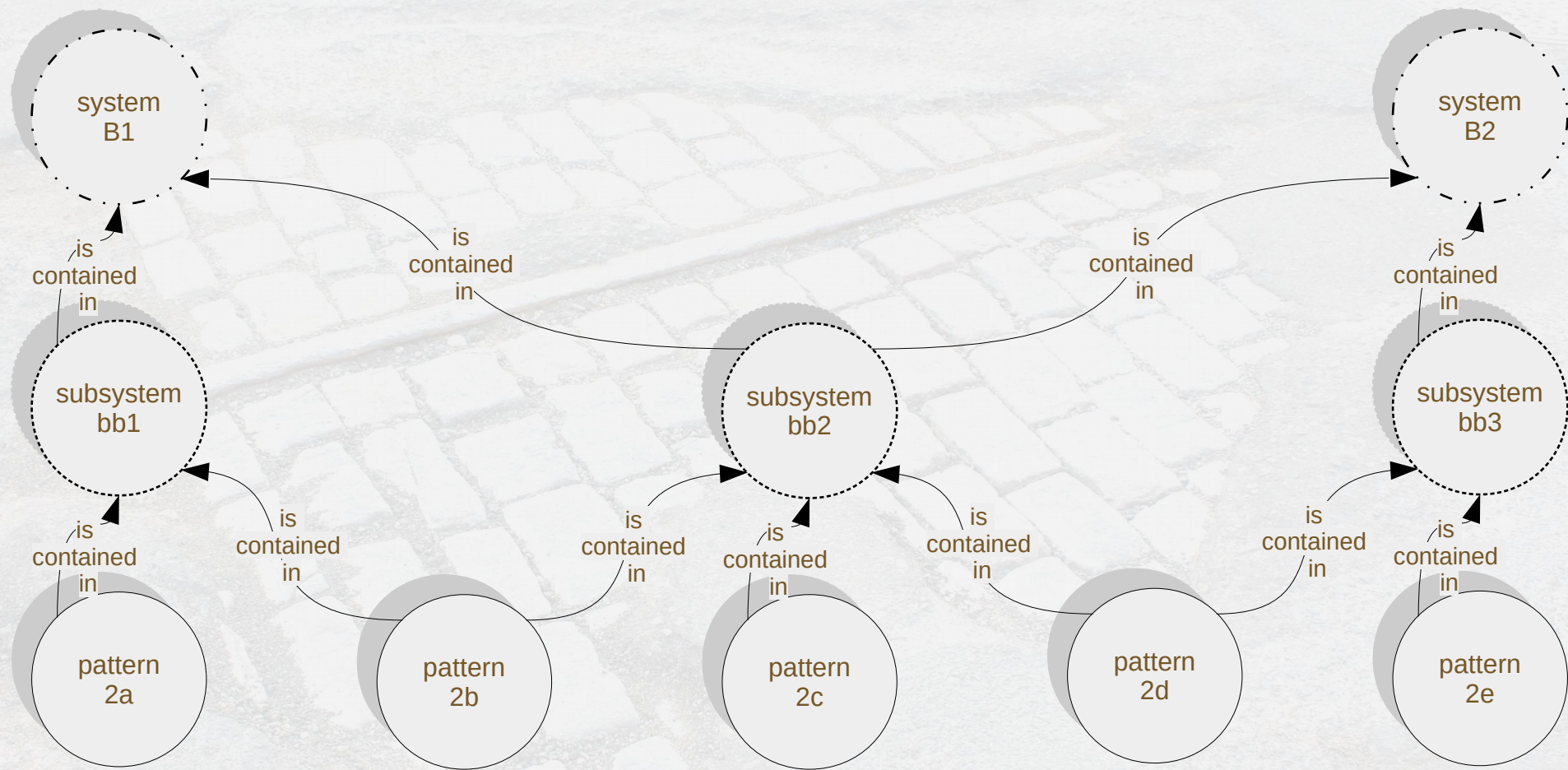
Alexander, Christopher, Sara Ishikawa, and Murray Silverstein. 1967. *Pattern Manual*. Berkeley, California: Center for Environmental Structure.



# Systems, subsystems, patterns

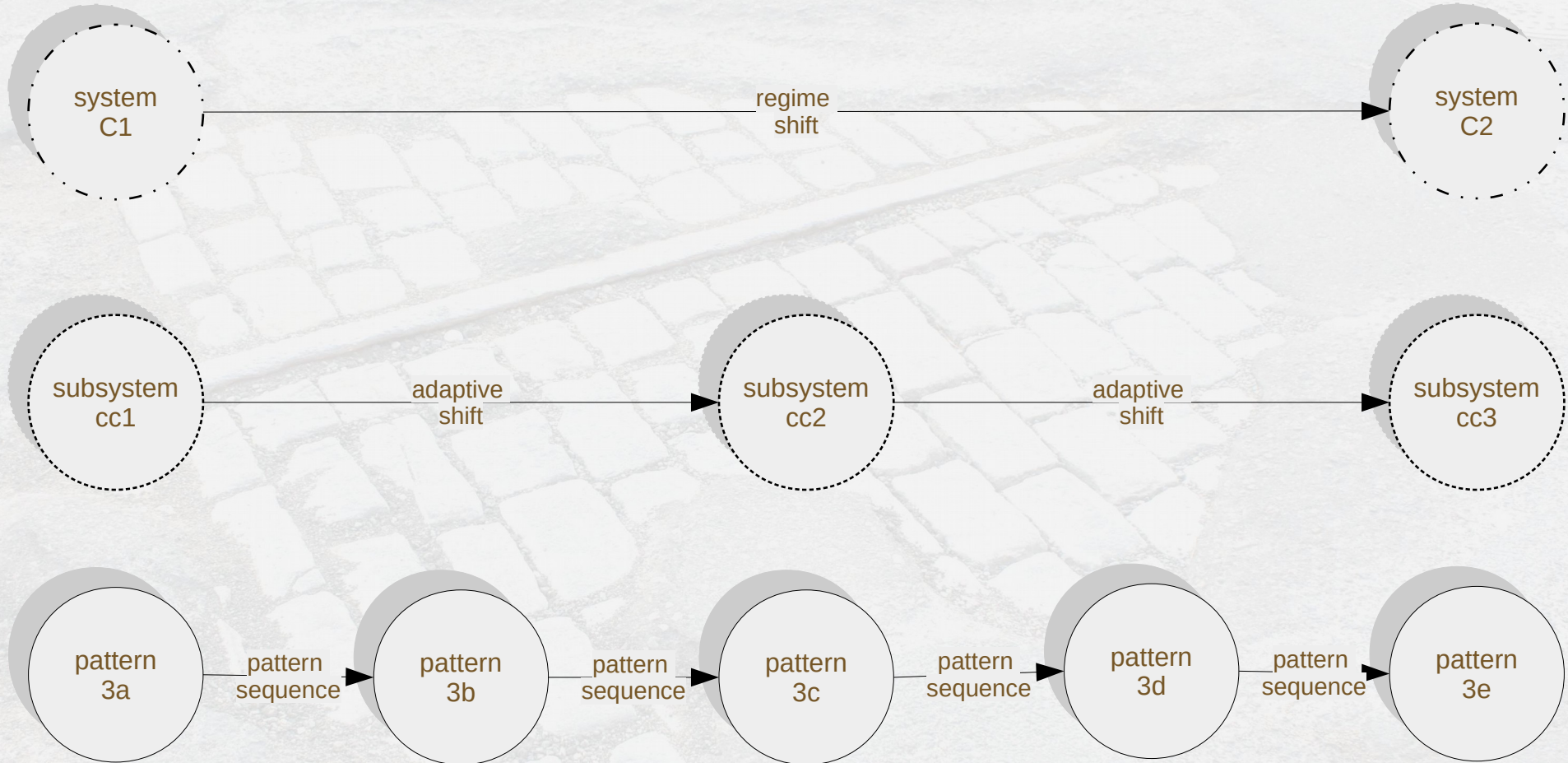


# Scales: systems, subsystems, patterns





# Systems shifts, subsystems shifts, pattern sequences



# Amplifications from Alexandrian to service systems thinking

## 1. Shared meaning on the situated

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).

## 2. Systems thinking and complexity

### Systems generating systems

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.
- 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).

## 3. Method content + development process

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 use 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).



# Rephilosophizations from Alexandrian to service systems thinking

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



# Reinterpretations from Alexandrian to service systems thinking

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



# Agenda

[preamble] Systems Changes and Action

A. (Human) Errors + (Systems) Breakdowns

B. Systems Approaches: Behavioral + Ecological

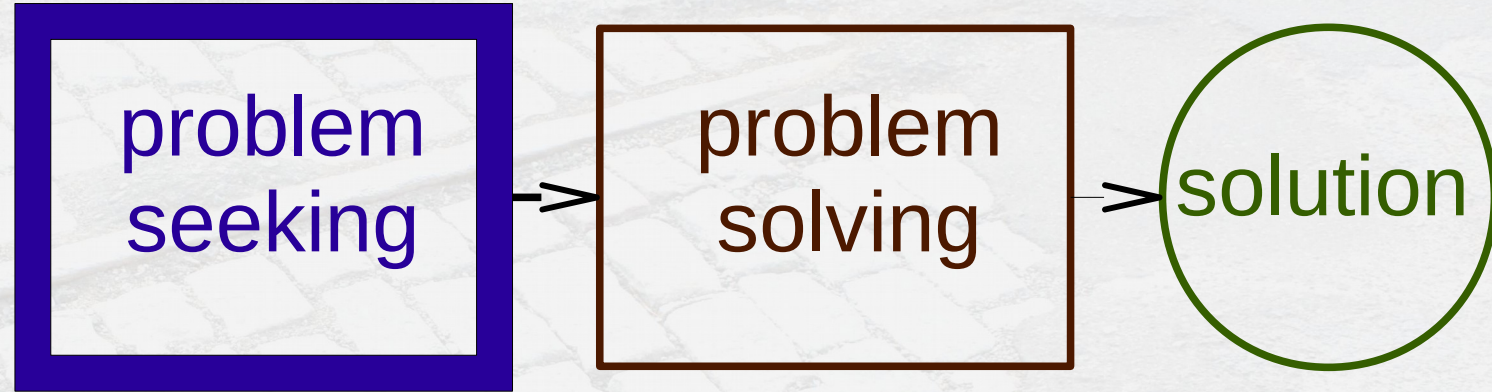
C. Action Learning + Pattern Sequences

[postscript] Multi-Paradigm Inquiry

# 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

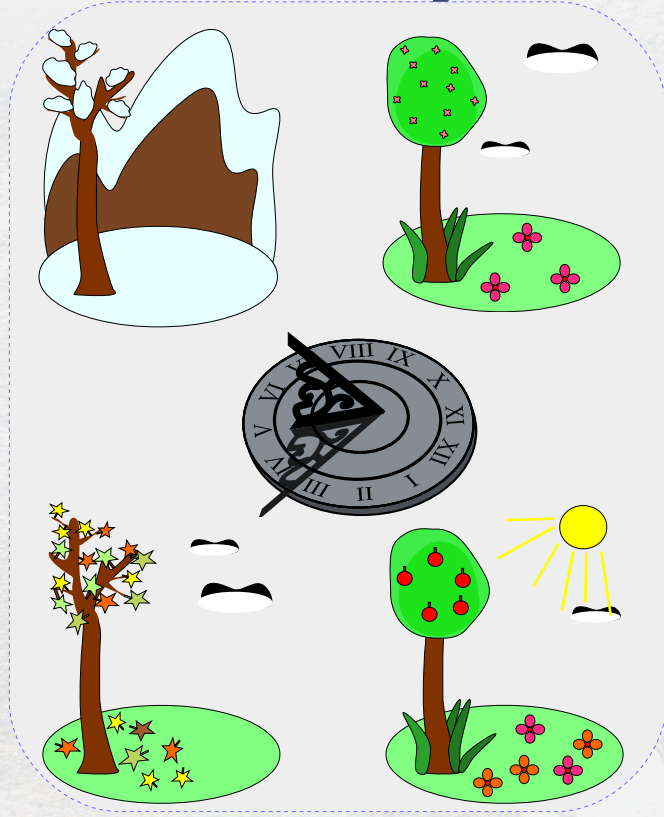
**Architectural thinking** as  
shaping the structure of the environment ...

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

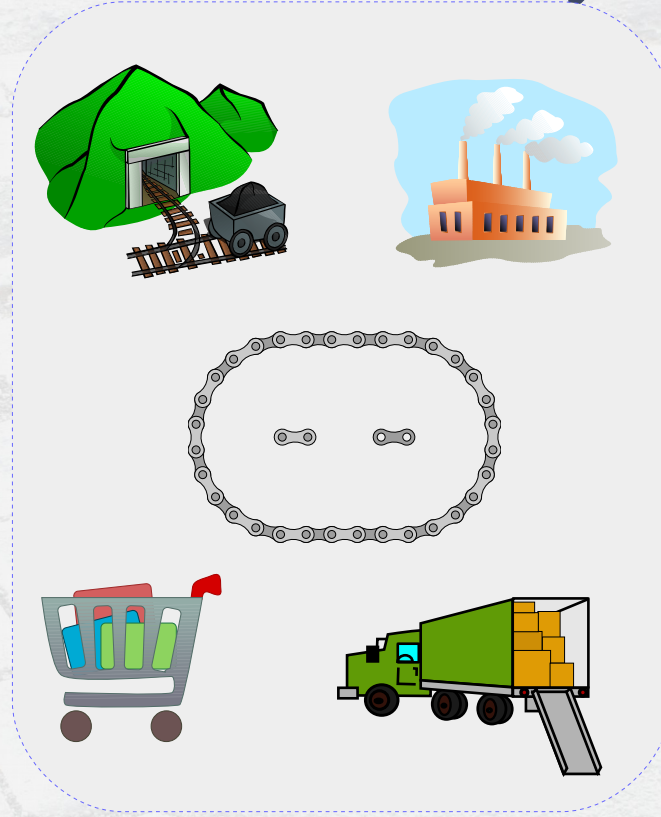
assembly lines are **allopoietic**,  
externally-organizing and externally-generating.

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

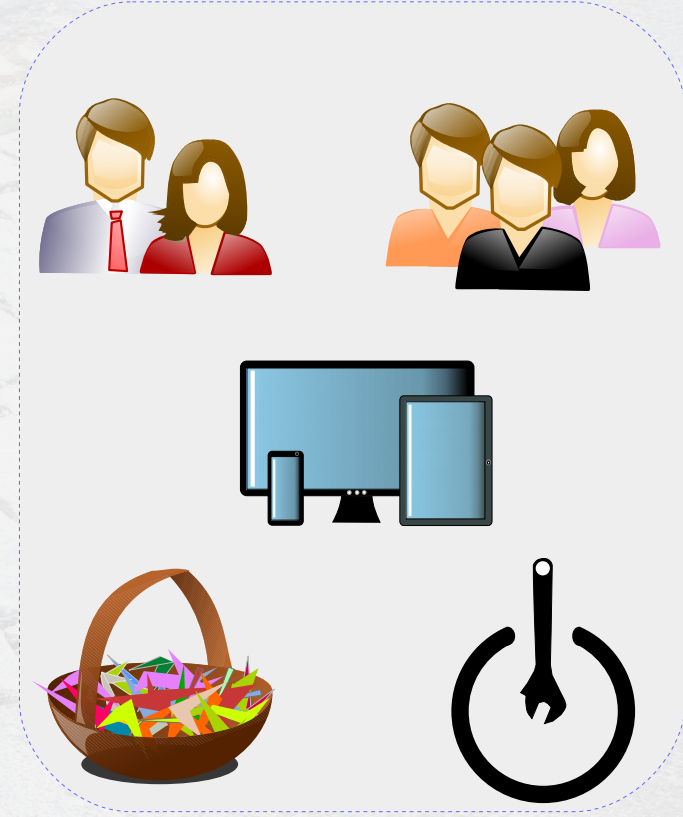
# Is thinking different across agricultural systems, industrial systems, and service systems?



**Agricultural Systems**



**Industrial Systems**



**Service Systems(?)**



# Contrasting modes of thinking may be grounded in philosophy

Dualistic (Modern Western formal logic)		Contextual-dyadic (Classical Chinese implicit logic)
Abstract and permanent, is independent of context <ul style="list-style-type: none"><li>• Can extrapolate from propositions</li></ul>	Truth - Falsity	Application and meaning is relative to a particular context <ul style="list-style-type: none"><li>• Evaluate assertion as embedded</li></ul>
<i>Oppositions</i> Superior ↔ Inferior Superordinate ↔ Subordinate Intrinsic value ↔ Non-intrinsic value Human ↔ Nonhuman	Pairings	<i>Characteristics under context</i> A term presupposes its opposite <ul style="list-style-type: none"><li>• e.g. <i>cat</i> implies <i>non-cat</i>, not universe</li></ul> Context-dependence <ul style="list-style-type: none"><li>• e.g. men or women superior when/where?</li></ul>
Hierarchical Reductionist Entity- (thing-) ontology	Frames	Yin-Yang Harmonious whole Mutually engendering or constraining

Lee, Keekok. 2017. The Philosophical Foundations of Classical Chinese Medicine: Philosophy, Methodology, Science. Lexington Books.  
<https://rowman.com/ISBN/9781498538886/The-Philosophical-Foundations-of-Classical-Chinese-Medicine-Philosophy-Methodology-Science>.







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