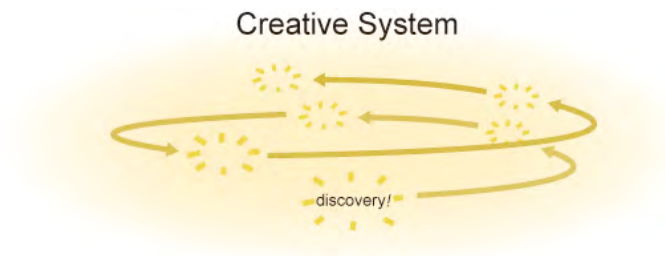


An Autopoietic Systems Theory for Creativity



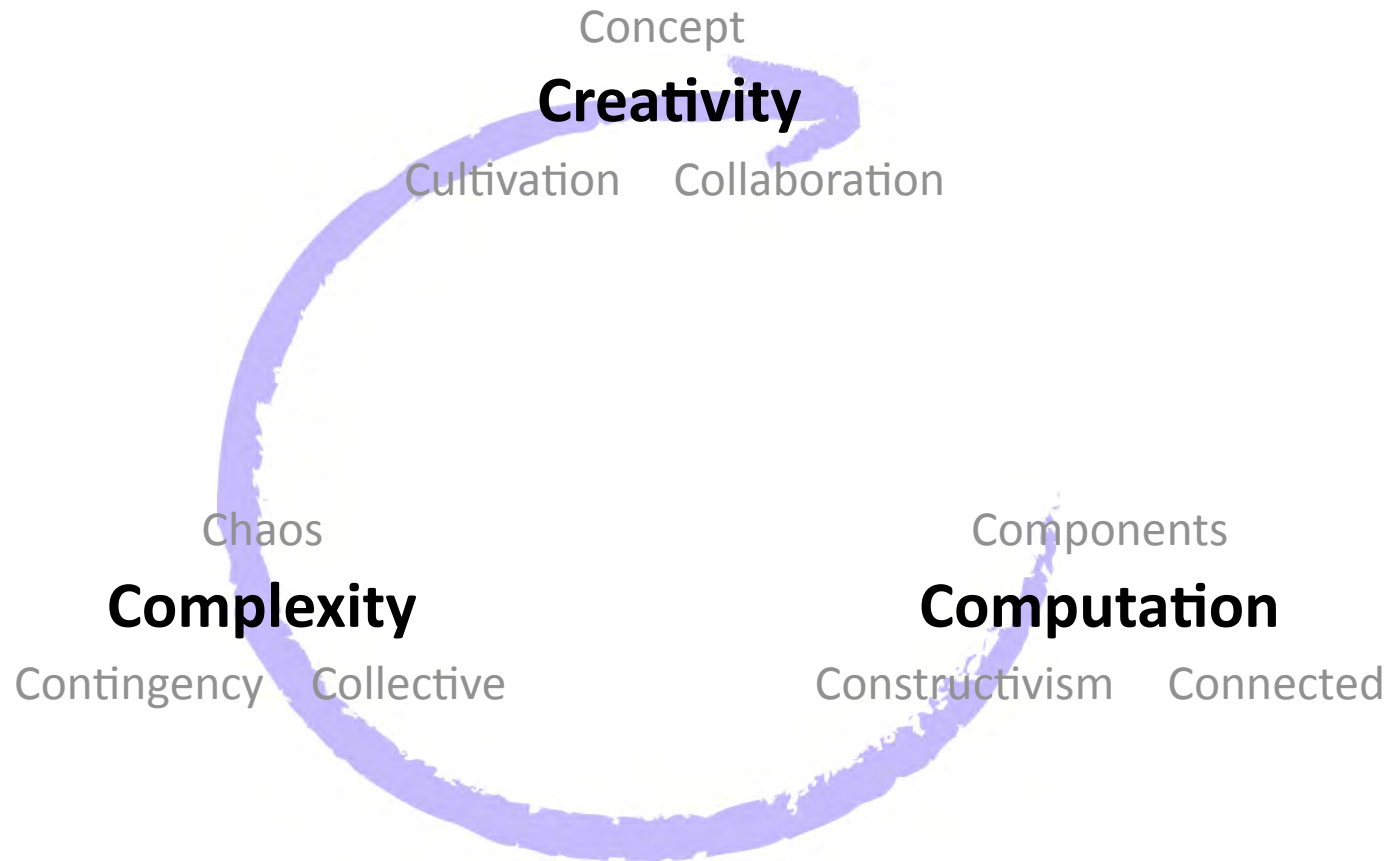
Takashi Iba

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MIT Center for Collective Intelligence, USA

Faculty of Policy Management, Keio University, Japan

My Interests



“Creativity” Matters!

Open Collaboration

Mass Collaboration

Conceptual Age

Creative Class

Collaborative Innovation Networks (COINs)

Coolhunting & Coolfarming

Swarm Creativity

Organizational Creativity

Collective Creativity

Creative Collaboration

Design Thinking

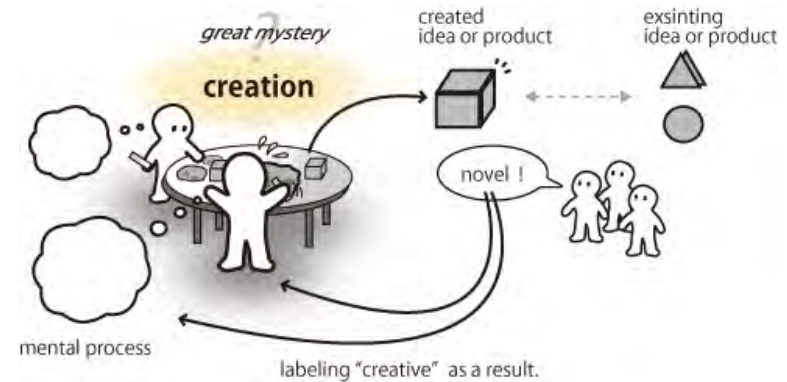
Group Genius

Group Creativity

Innovation

Puzzles in Creativity

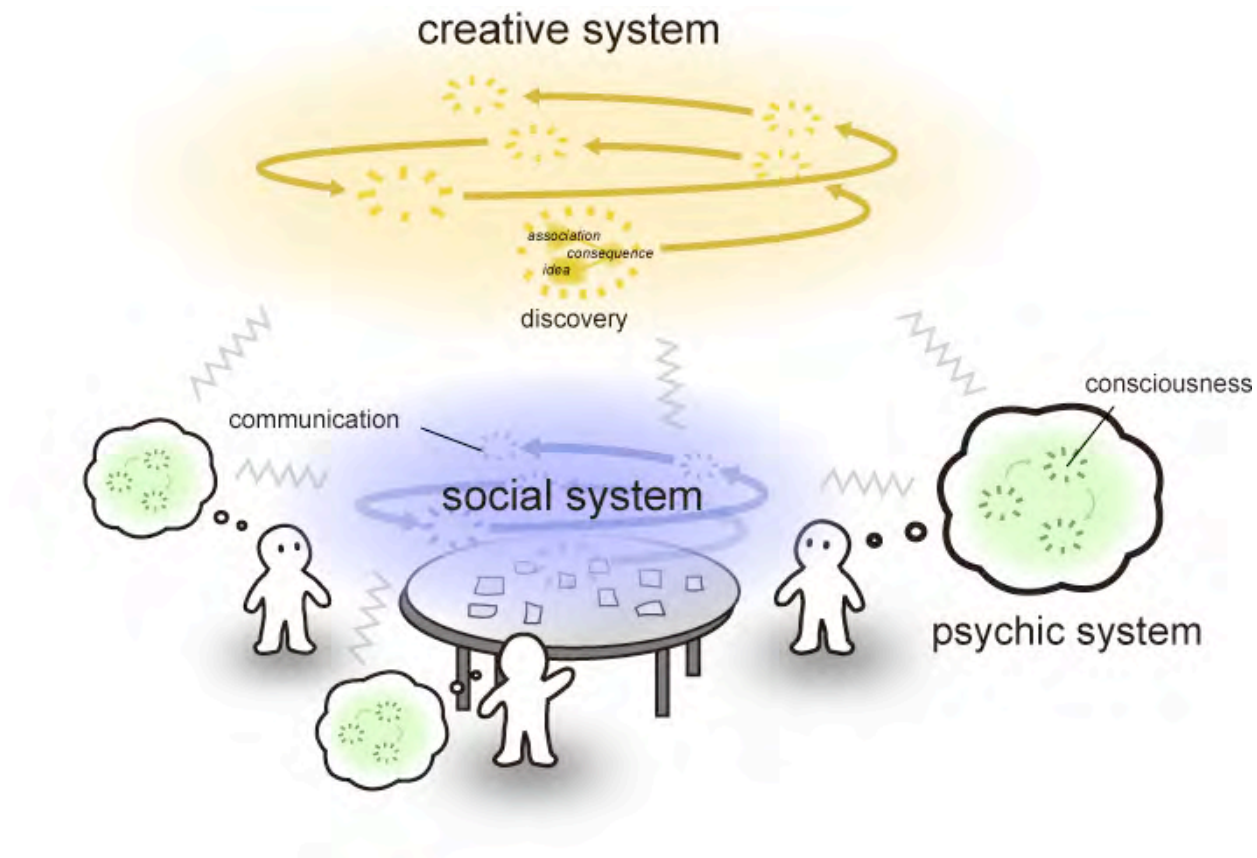
- Can't one call a process "creative" without the evaluation of novelty by others?
 - Creativity is often defined by referring to others' evaluations about the novelty of idea, product, or outcome.



- How can we formulate creative processes that contain much of contingency?
 - Creative processes do not follow deterministic laws, but not happen at random.
 - Sources of discoveries are quite diverse and depends on circumstances, for example, logical deduction, induction, abduction, analogy, metaphor, inspiration, and just accident.
- Are there any difference between individual and group creativity?
 - If there is differences, it means that there are two types of creativity.
 - Otherwise, a feature called "creativity" can be realized in the different bases: mind inside an individual and group made of individuals.

An alternative approach is necessary to describe *what goes on in a creative process*.

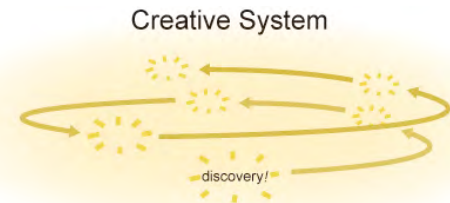
“Creation” as Coupling of Creative, Psychic, and Social Systems



An Autopoietic Systems Theory for Creativity

- “Creative Systems Theory”

- Creative process is an “autopoietic system”.
- Name it “creative system”.
- Elements are “*discoveries*”.
- A *discovery* is emerged by a synthesis of three selections: *idea, association, and consequence*.
- “*Discovery media*” transform improbability of *discoveries* to probable.



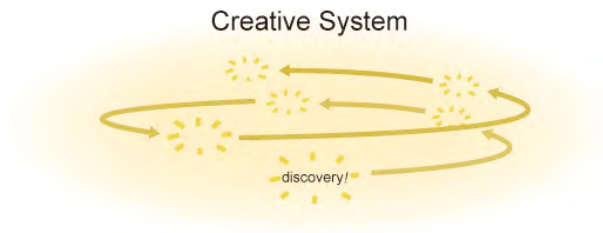
- Coupling of creative, psychic, and social systems

- The Future of Creativity Studies

- “Creatology” as a discipline to study creative systems.
- “Creative Sciences” as a interdisciplinary field to study creativity.

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Autopoiesis

- self-production
 - Invented from Greek words by Maturana & Varela (1972; 1980)
 - “auto” (*αυτό*) for “self-”
 - “poiesis” (*ποίησις*) for “production”
 - Opposite to “allopoietic”.
- Autopoietic system
 - System that produces itself
- Niklas Luhmann generalized the theory and applied it to sociology
 - “Social Systems Theory” (Luhmann 1984).



Brief History of Systems Theories

Generation	Spotlighted System	Key Concept	Leading Scholars (Theory)
1st	dynamic nonequilibrium system	homeostasis	W. B. Cannon (homeostasis) L. Bertalanffy (general system theory) N. Wiener (cybernetics) W. R. Ashby (cybernetics) T. Parsons (social systems theory)
2nd	dynamic equilibrium system	self-organization	Ilya Prigogine (dissipative structure) Manfred Eigen (hypercycle) Hermann Haken (synergetics)
3rd	self-production system	autopoiesis	Humberto Maturana (autopoiesis) Francisco Varela (autopoiesis) Niklas Luhmann (social system theory)

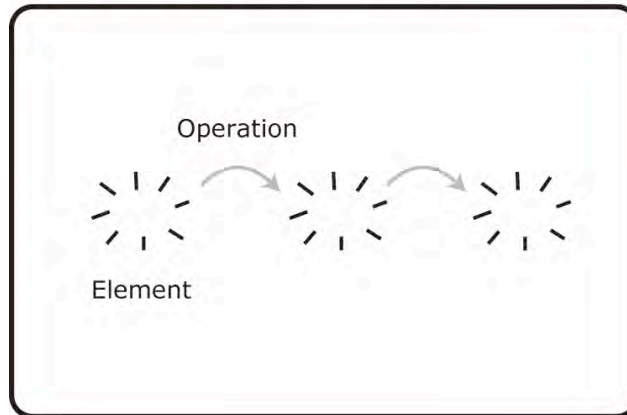
The difference between “self-organization” and “autopoiesis”

- “Self-organization” is focused on *structural* formation.
- “Autopoiesis” is focused on *system* formation.

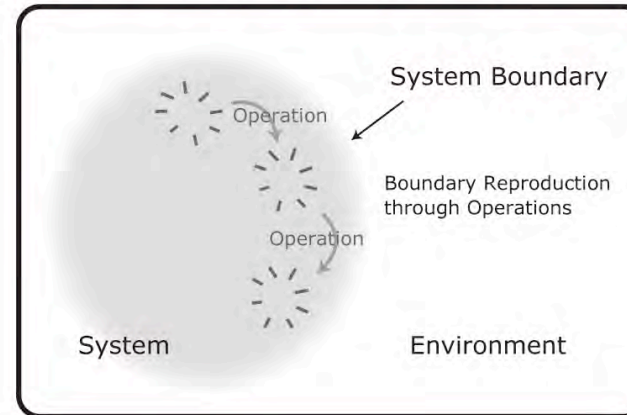
Structure: → larva → chrysalis → butterfly
System: Life →————→

Autopoietic System: System Formation

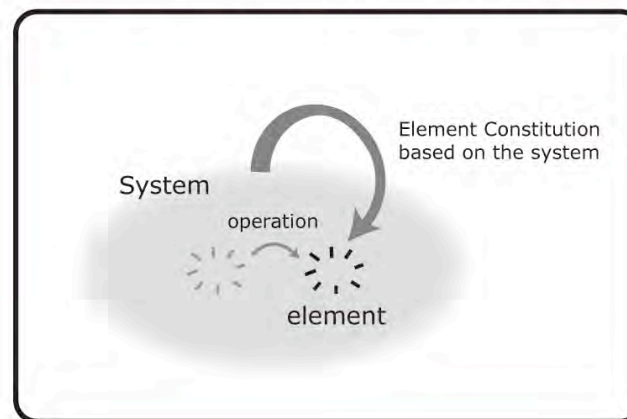
(1) Element as Momentary Event



(2) Boundary Reproduction of the System



(3) Element Constitution based on the System



* The following explanation of autopoiesis based on my interpretation of the formulation by Niklas Luhmann.

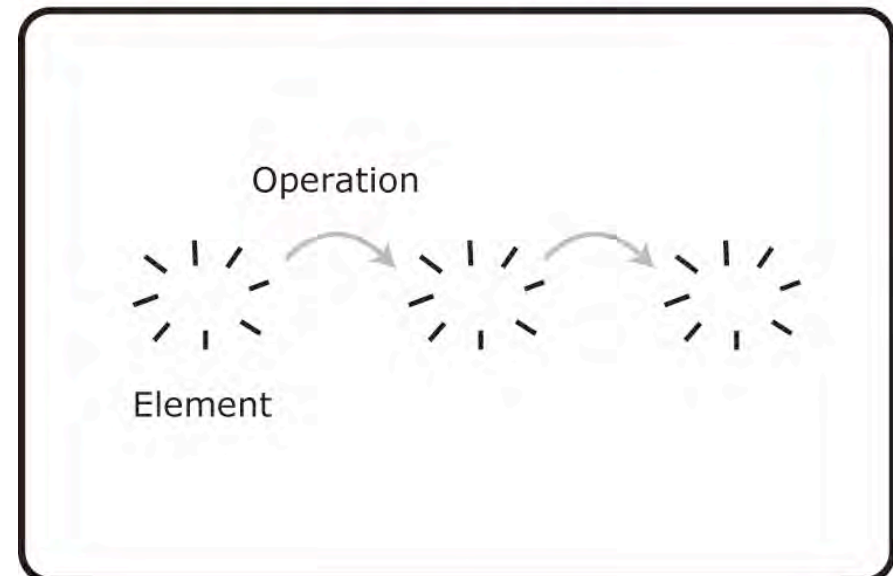
Autopoietic System: System Formation

(1) Element as Momentary Event

- Shift of viewpoint about element from substances to momentary events.
 - Elements are momentary events that has no duration.
 - They disappear as soon as they are realized.

- Consequently, the system must produce the elements in order to keep existing.

(1) Element as Momentary Event

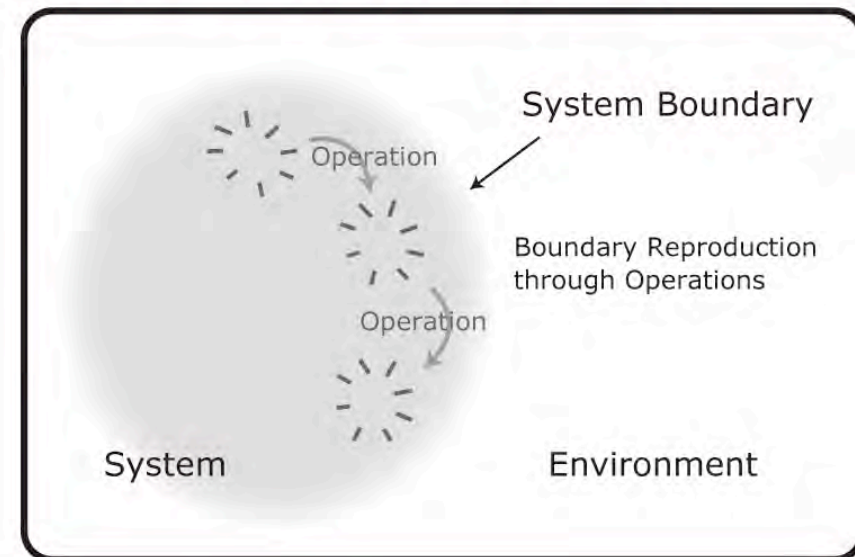


Autopoietic System: System Formation

(2) Boundary Reproduction of the System

- Boundary of the system is determined by the operations.
- Inside the boundary is called “system”.
- Outside the boundary is called “environment”
 - Environment can be indicated as the outside of the system.
- Thus, each autopoietic system is operationally closed.

(2) Boundary Reproduction of the System

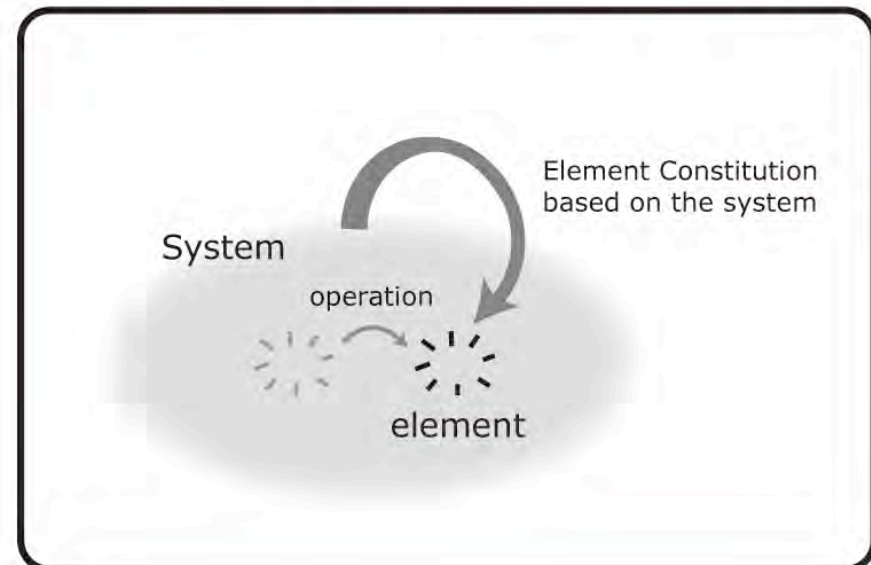


Autopoietic System: System Formation

(3) Element Constitution based on the System

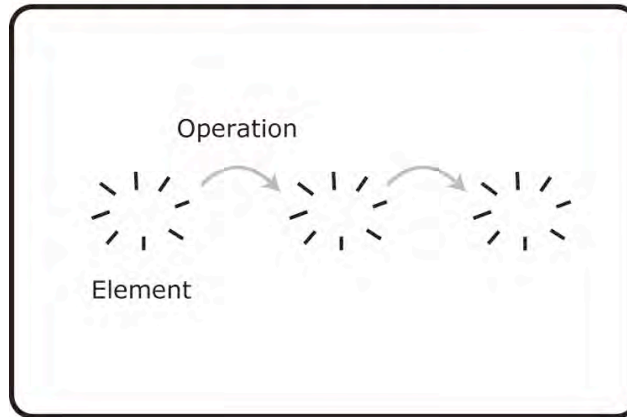
- Elements are constituted based on the on-going system.
- Thus, autopoietic systems are defined in a circular fashion.
 - A System consists of elements that is momentary event.
 - Elements are constituted based on the system.

(3) Element Constitution based on the System

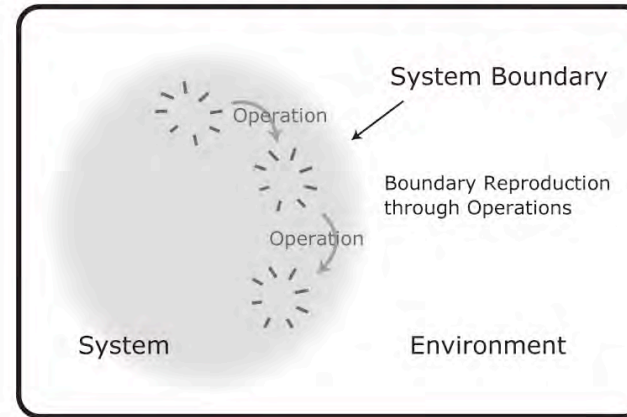


Autopoietic System: System Formation

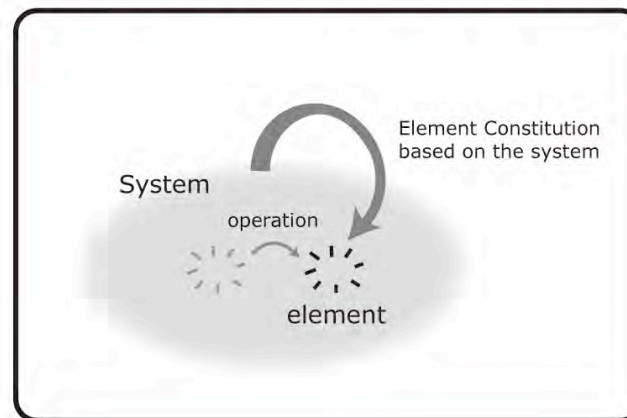
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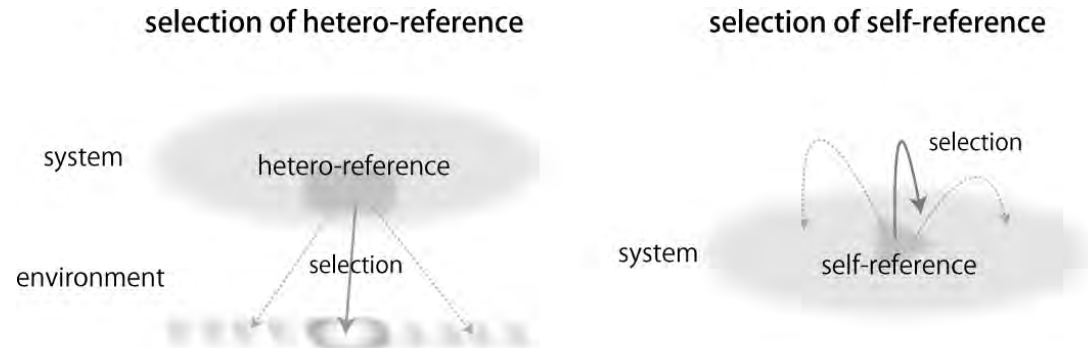


(3) Element Constitution based on the System

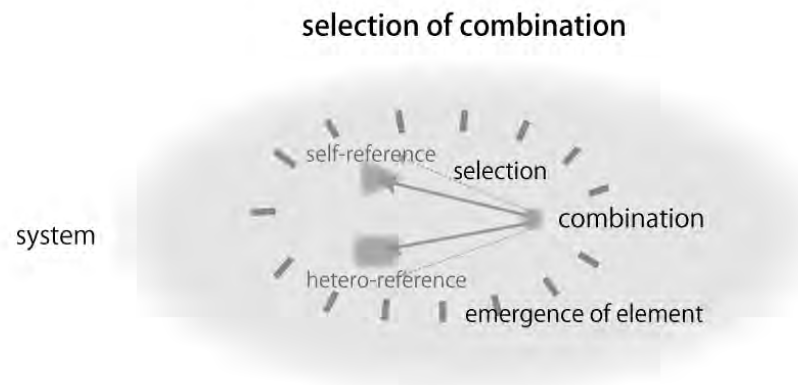


Autopoietic System: Element Constitution

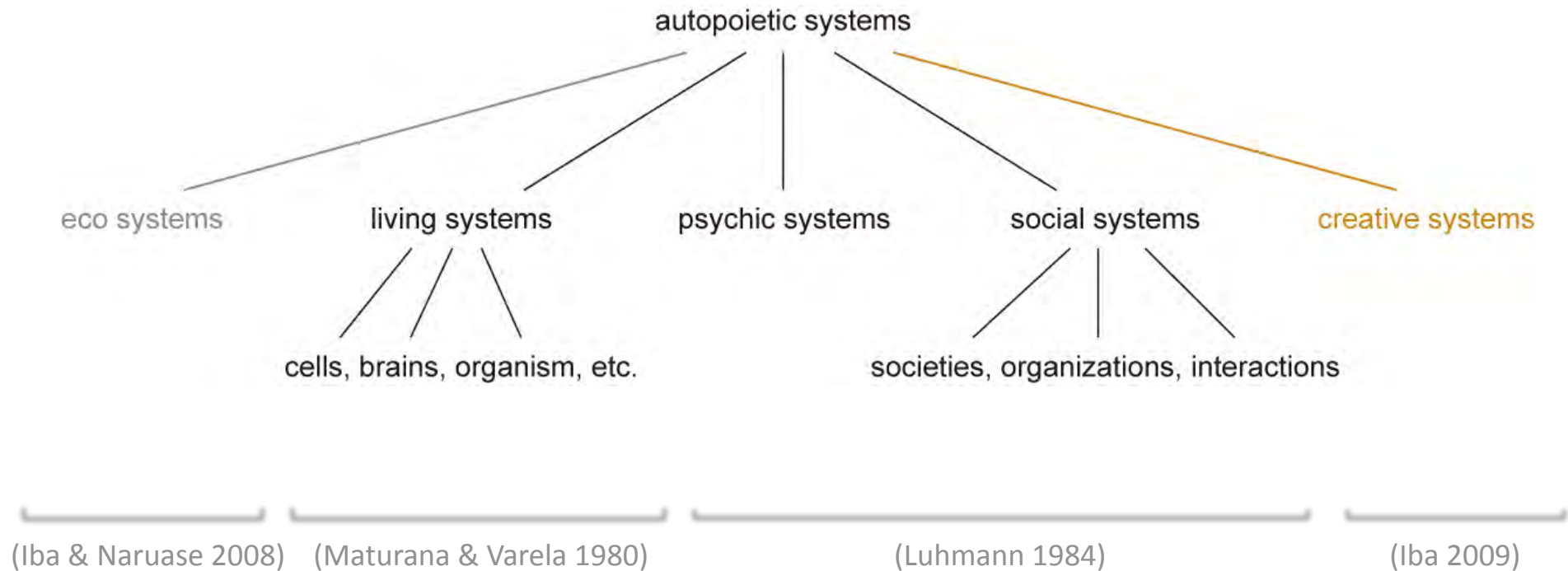
- An element is emerged only when a synthesis of three selections occurred
 - *hetero-reference*
 - *self-reference*
 - *combination of hetero-reference and self-reference*



Note that “Selection” just means the reduction of complexity in contingent situation, therefore without the reference to anybody’s mind.
(cf.) Darwin’s “Natural Selection”

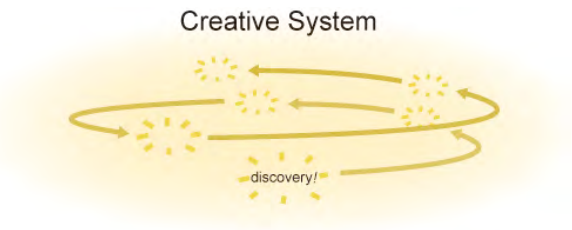


Several Types of Autopoietic Systems



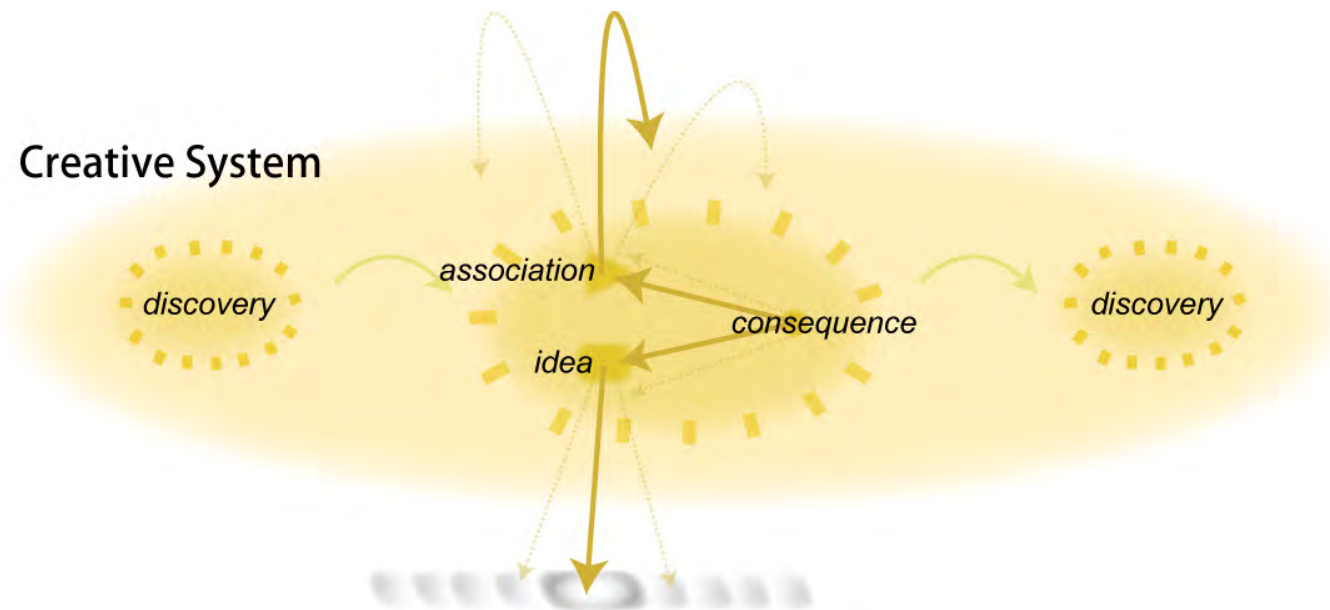
An Autopoietic Systems Theory for Creativity

- “Creative Systems Theory”
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 - Name it “creative system”.
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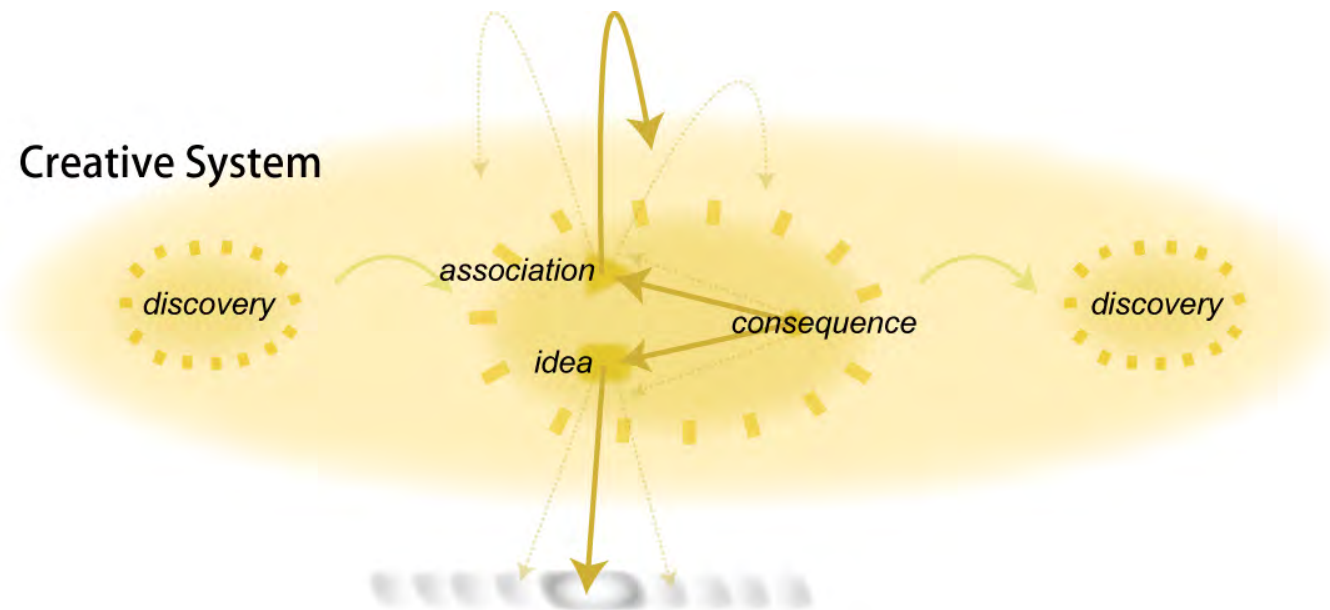
Creative Systems: System Formation

- Creative system is an autopoietic system whose element is *discovery*.
 - *Discovery* is produced by previous *discovery*, based on on-going creation.
 - *Discovery*, in this context, does not imply it is novel, true, and useful.



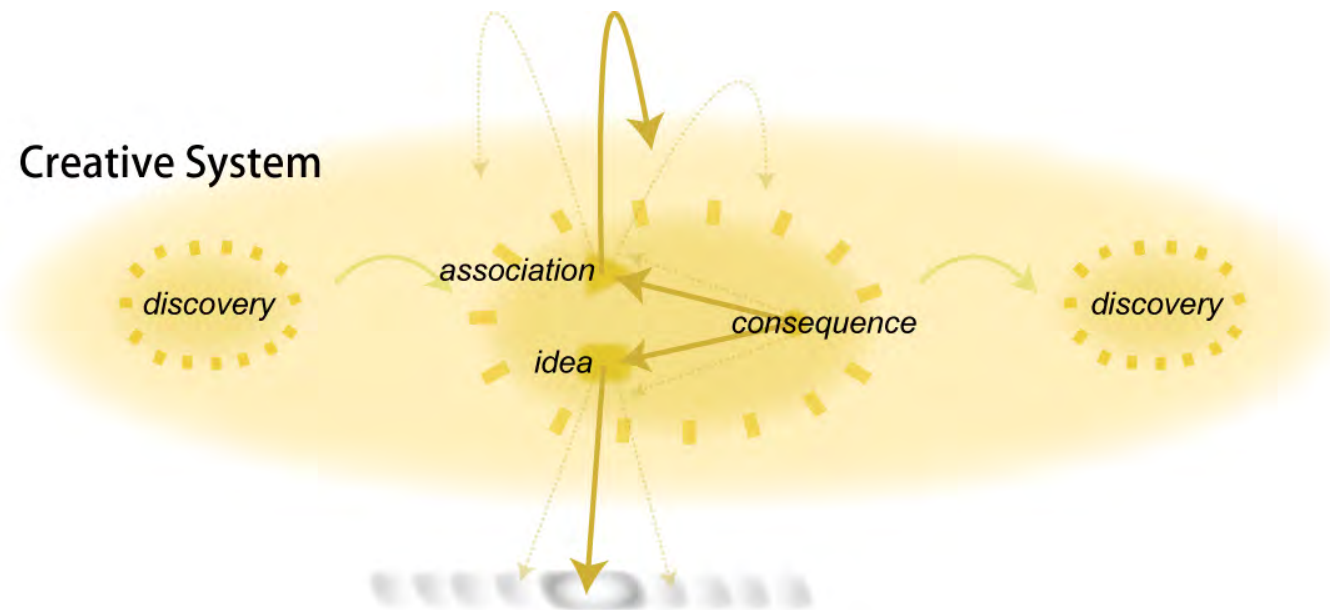
Creative Systems: System Formation

- “They succeed by way of many small sparks, and by drawing on collaboration over time to build those sparks into something tremendous. Many of the idea turn out to be wildly off the mark, but it turns out many not-so-good ideas are needed on the way to that rare great idea.” (Sawyer 2007; p.105)
- "Darwin's notebook show that he reached many dead ends and produced a lot of ideas that scientists now consider weird." (Sawyer 2007, p.106)



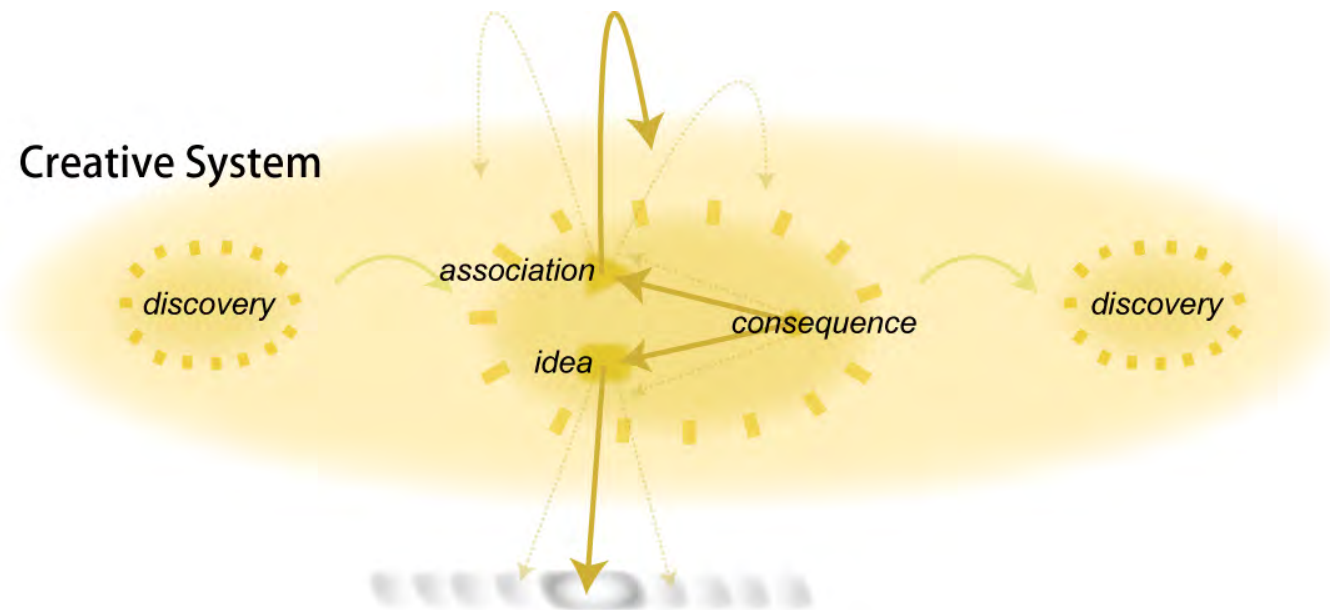
Creative Systems: System Formation

- It does not matter where and how *discoveries* come from.
 - Maybe from deliberation, inspiration, or merely by accident.
 - Maybe by somebody alone or collaboration by more than one person.
- What is most important here is just successive production of *discoveries*.



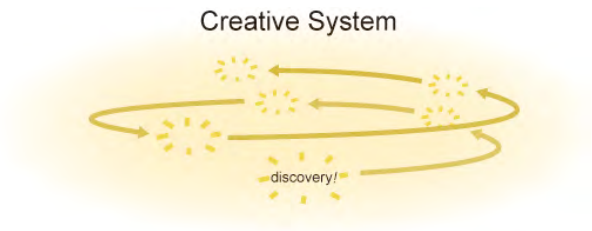
Creative Systems: Element Constitution

- *Discovery* is emerged from a synthesis of three selections: selections of "*idea*", "*association*", and "*consequence*".
 - *Idea* exists only inside the system. It is meaningful only for ongoing creation.
 - *Association* can exist meaningfully only inside the system, too.
 - *Consequence* occurs only as the combination of *idea* and *selection*, therefore it also can exist only inside the system.



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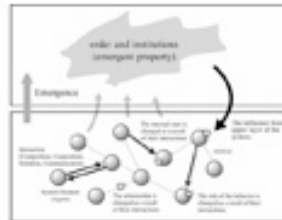


Creative Systems: Uncertainty and Media

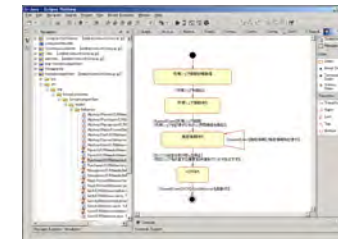
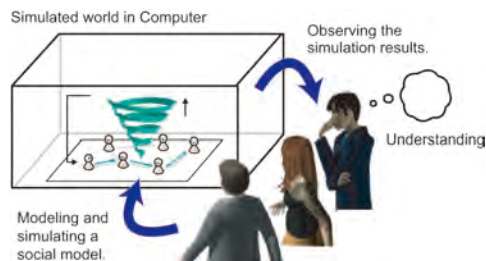
- There are intrinsically uncertainties for realization of *discovery*.
 - (1) Uncertainty about *association of idea*.
 - Thinking newly means that there is no guarantee that the *association of idea* is possible to apply.
 - (2) Uncertainty about far-reaching *consequence* from *association of idea*.
 - It is quite difficult to get *consequences* by thinking about complicated logic.
- “*Media*” for overcoming these uncertainties
 - Methods, theories, and rule of thumb work as *media* for uncertainty (1).
 - They provide schema to reduce the complexity for selection of *idea* and *association*.
 - Tools, like computer simulation, network analysis, text mining, and statistical analysis, work as *media* for uncertainty (2)
 - They contribute greatly to decrease the possibility to stop in midcourse by enhancing efficiency rather than human labor.

“Discovery Media”

- *Discovery Media* against uncertainty about *association of idea*
 - Modelling Languages: “PlatBox Foundation Model” by T. Iba *et. al.*
 - Pattern Languages: “Learning Patterns” by T. Iba *et. al.*



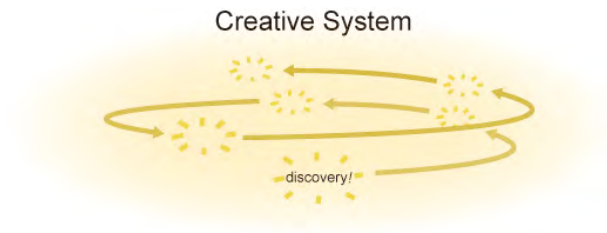
- *Discovery Media* against uncertainty about far-reaching *consequence*
 - Dynamic Social Network Analysis Tools: “Condor” by P. Gloor *et. al.*
 - Computer Simulation Tools: “PlatBox Simulator” by T. Iba *et. al.*



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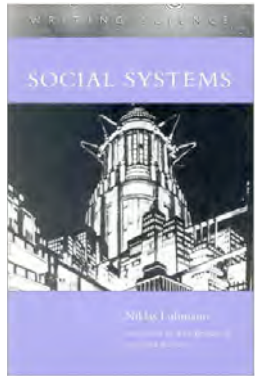


- Coupling of creative, psychic, and social systems

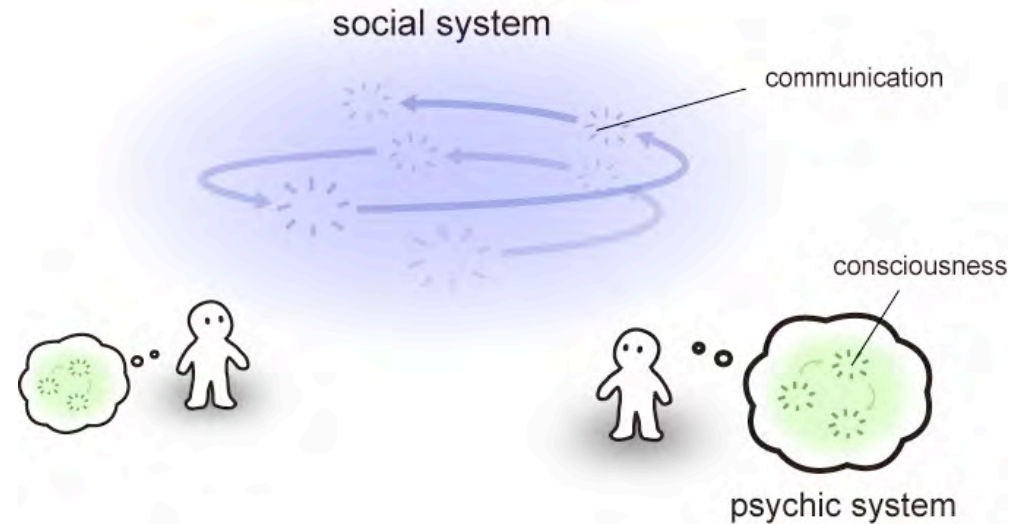
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Psychic System and Social System

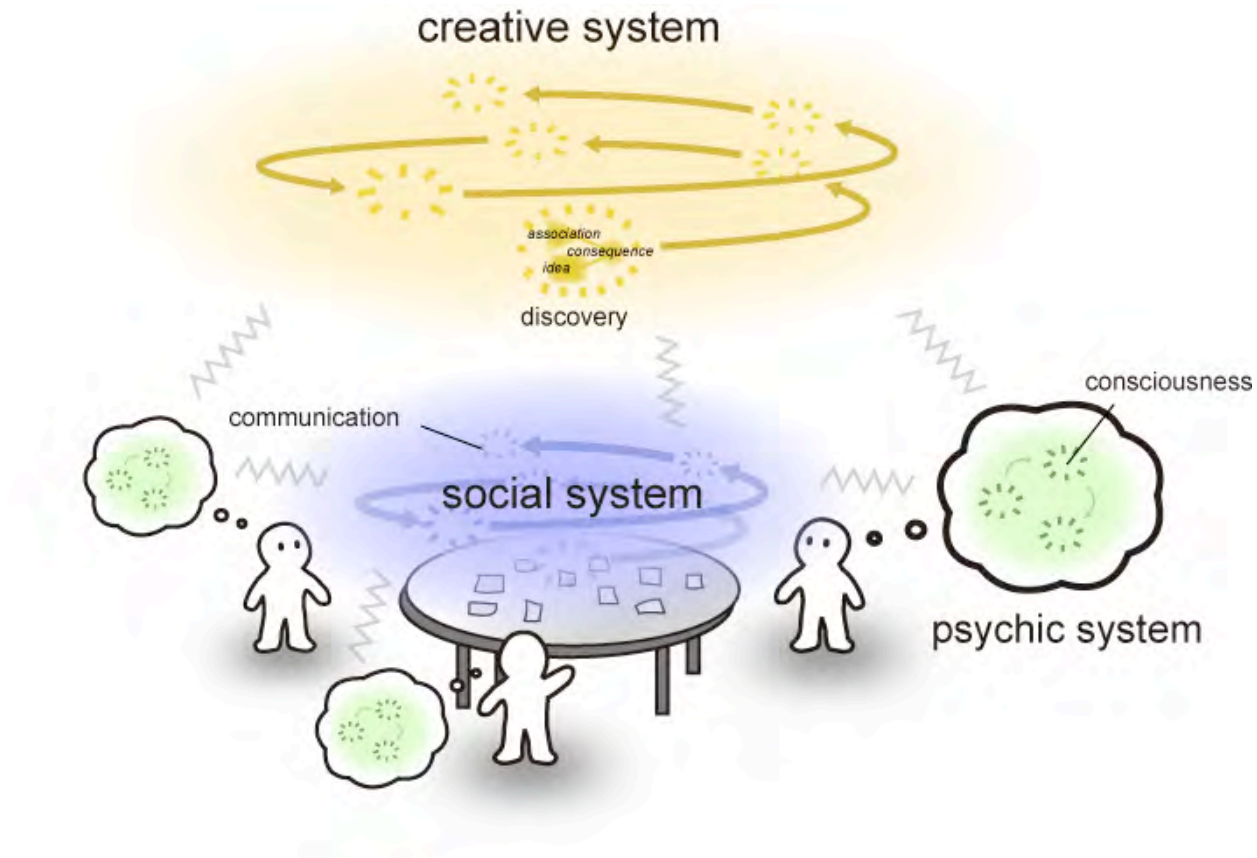


(Luhmann 1984)

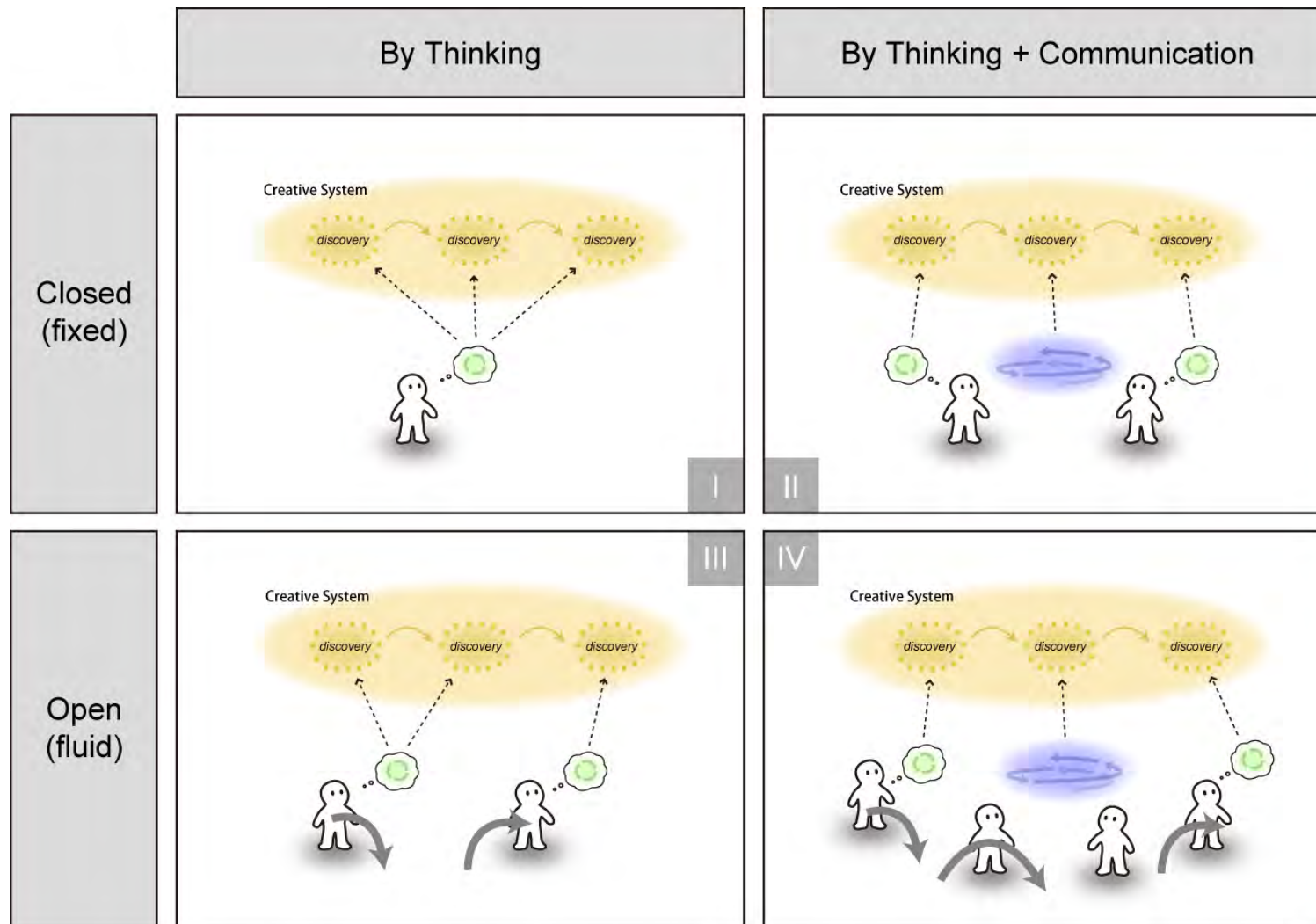


	Creative Systems	Social Systems	Psychic Systems
element	<i>discovery</i>	<i>communication</i>	<i>consciousness</i>
hetero-reference	<i>idea</i>	<i>information</i>	
self-reference	<i>association</i>	<i>utterance</i>	
combination of self-reference and hetero-reference	<i>consequence</i>	<i>understanding</i>	

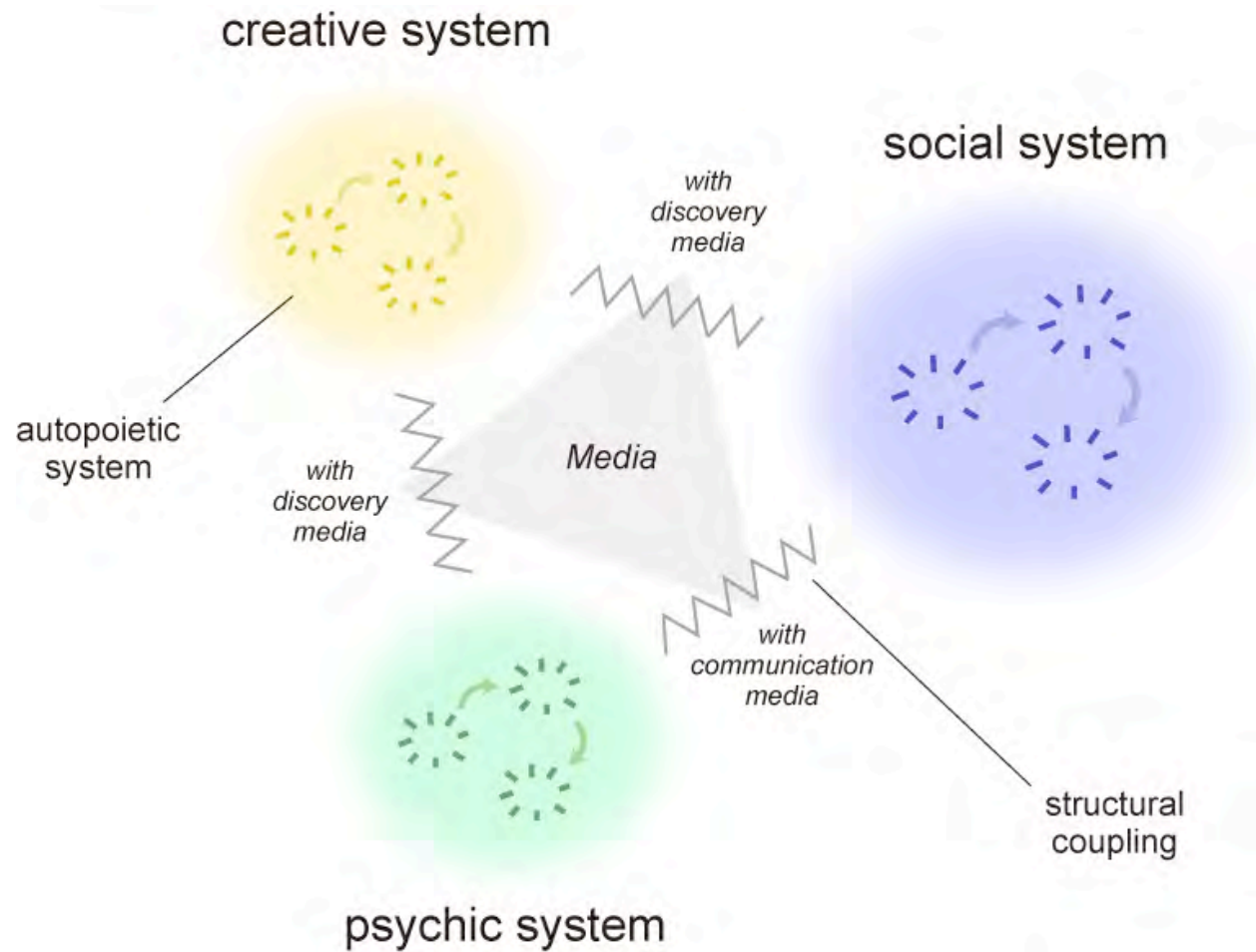
Coupling of Creative, Psychic, and Social Systems



Creative-Systems-Centered Viewpoint

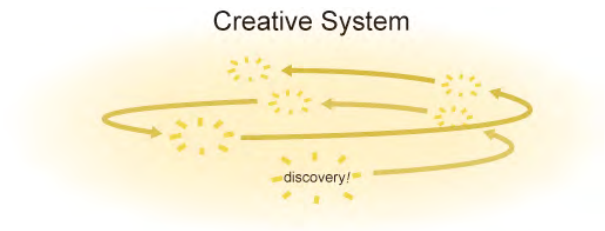


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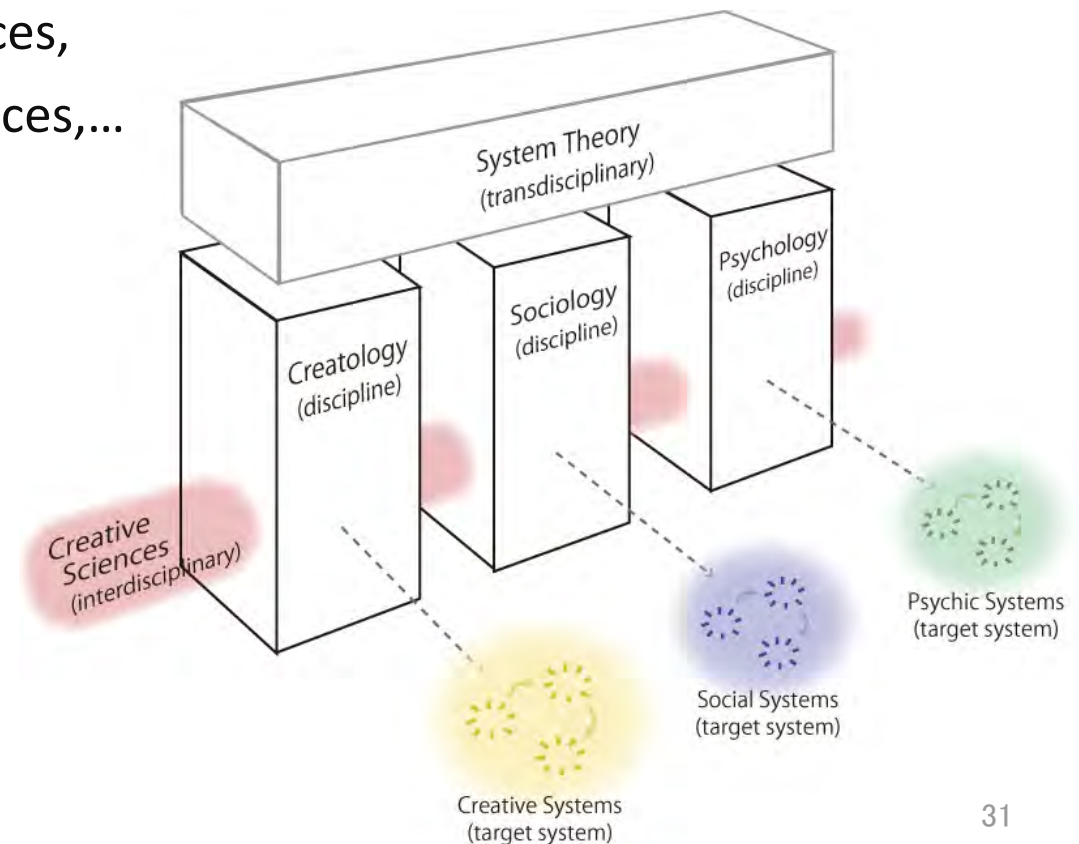
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The Future of Creativity Studies

- “Creatology” as a discipline to study creative systems.
 - proposed as a cross-disciplinary framework by I. Magyari-Beck (1977)
- “Creative Sciences” as a interdisciplinary field to study creativity.

Cf. Natural Sciences, Social Sciences,
Network Sciences, Learning Sciences,...



Implications

- Academic Implications
 - The theory of “Creative Systems” seems make sense.
 - Based on it, we can re-shape the disciplinary structure of creativity studies.
- Practical Implications
 - Imagine your creative process as chain reaction of discoveries.
 - Grow (cultivate or farm) your on-going creative system.
 - Pay attention to “discovery media” for growing it.

An Autopoietic Systems Theory for Creativity



Thank you!

ask your questions
slowly and clearly, please.

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