Pattern Literacy in support of Systems Literacy

Learning to find the patterns and create the models
that represent systems in words and pictures

Helene Finidori - Peter Tuddenham

61st ISSS Meeting - Vienna 9 -14 July 2017

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Work on and towards Pattern Literacy

Helene Finidori

Research on regenerative commons and federative strategies (Imagine the Common Good -2013, Economics and the Commons -2014)

First work on Pattern Languages and Systemic Change presented at the Workshop on the Ostrom Workshop (WOW5) at Indiana University 2014

Patterns as Epistemic Threads for Systemic Orientation presented at the Purplsoc workshop (2014) and conference (2015) at the Danube University in Austria

Patterns, Languages and Systemic Transformation submitted for H2020 grants in 2015 and 2016

Exploring the Potential of Patterns and Pattern Languages in Systemic Orientations workshop at PLoP 2016 and paper at ISSS 2016

PhD at the Centre for Systems Studies of the University of Hull under the supervision of Gerald Midgley started in 2017

Work on and towards Systems Literacy

Peter Tuddenham

Started with Ocean education in support of Geographical Literacy with National Geographic Society 2000.

Ocean Literacy 2004, Earth Science Literacy 2008 Atmospheric Science Literacy 2009

Attended ISSS and ASC in 2014 Washington DC

Systems Literacy initiative started at ISSS 2015 Berlin

Systems Literacy as focus of IFSR Conversation Linz, Austria, 2016

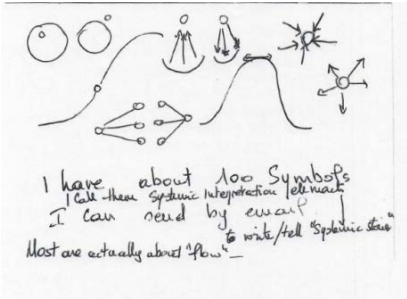
Systems Literacy Plenary presentations at ISSS 2016 Boulder

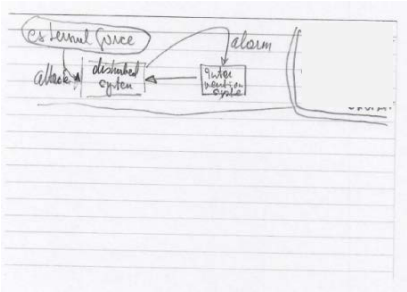
Systems Literacy workshops at INCOSE 2016

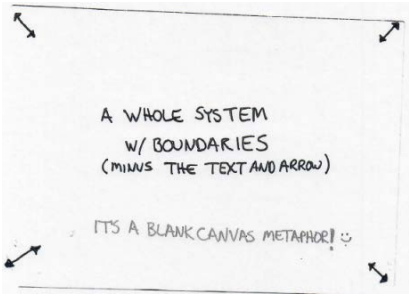
Systems Literacy - Learning from Nature

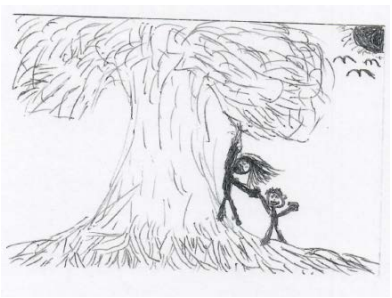
ISSS 2016 Systems Literacy Plenary

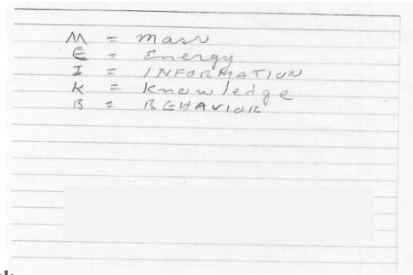
We asked people to draw a system and or symbols to represent essential principles or big ideas of Systems*. This is what we got.

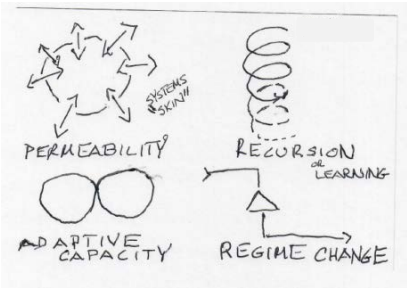


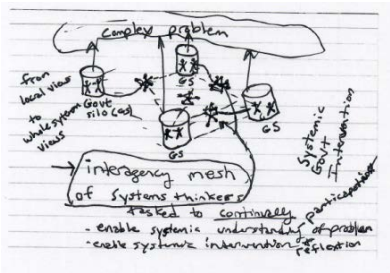


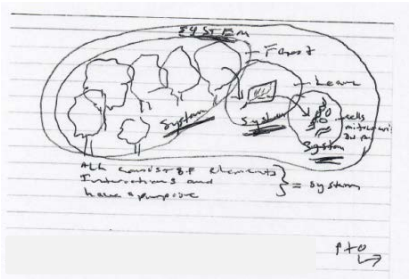












*From an idea by Billy Dawson

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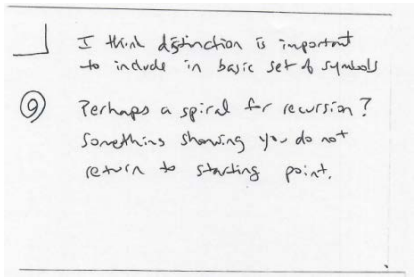

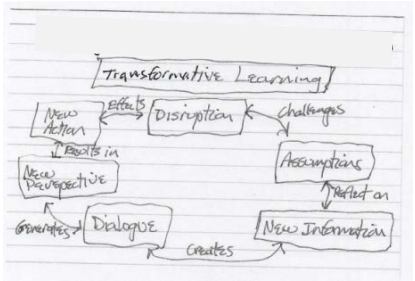

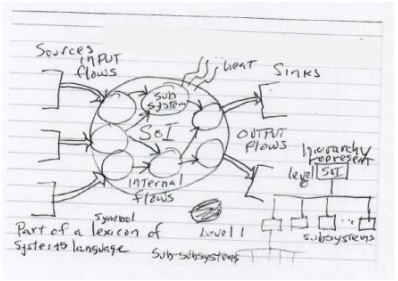

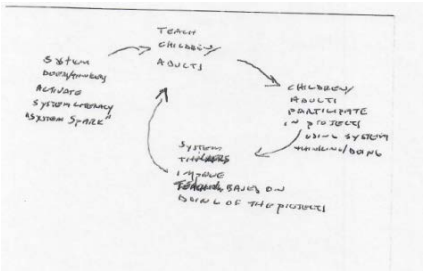

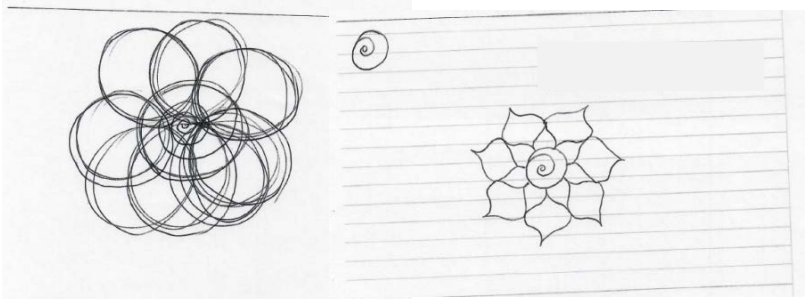

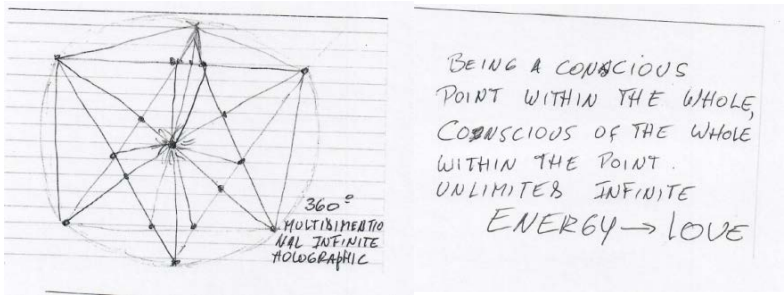

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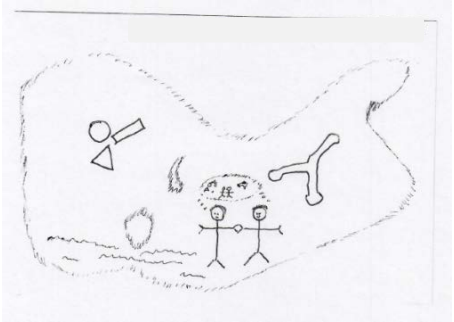

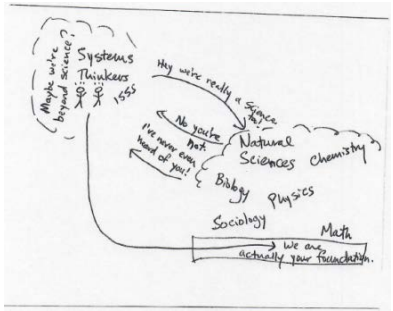

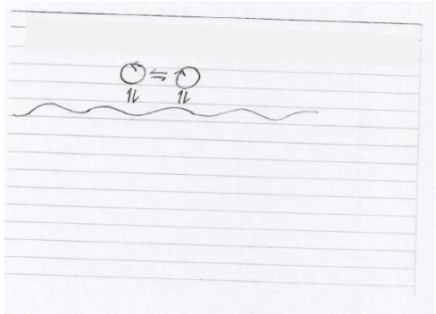

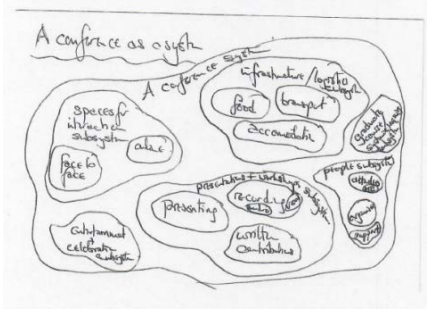

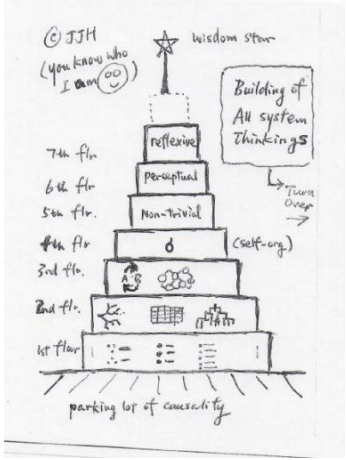

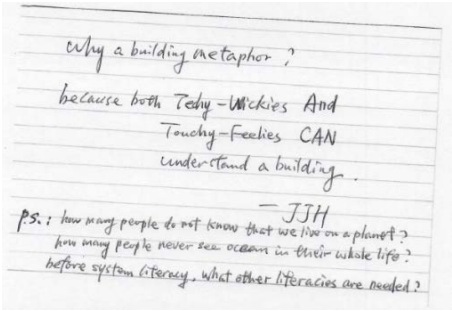

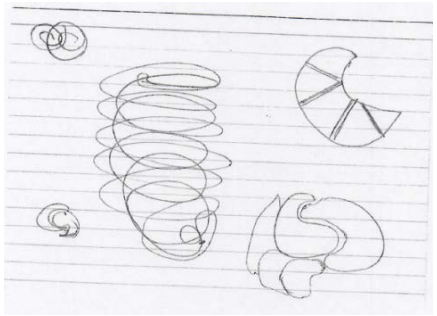

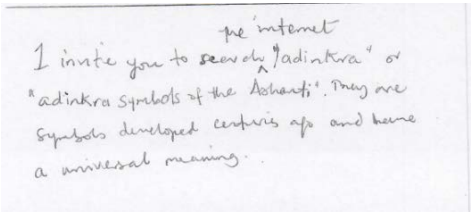

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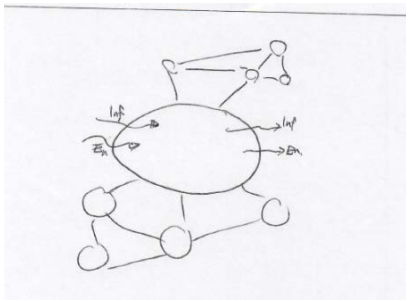

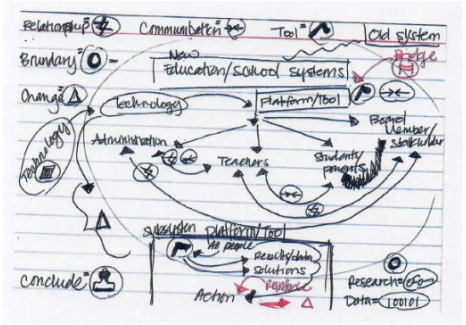

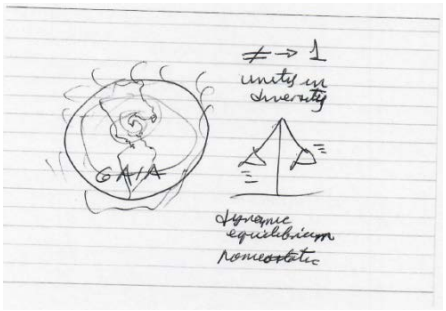

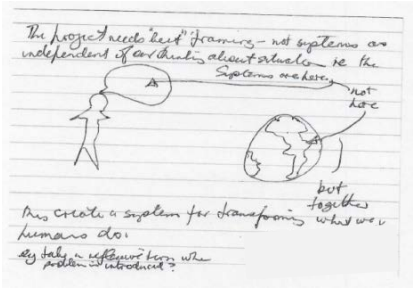

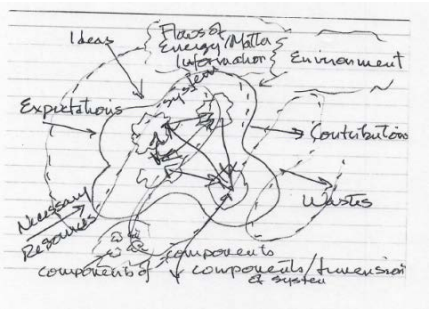

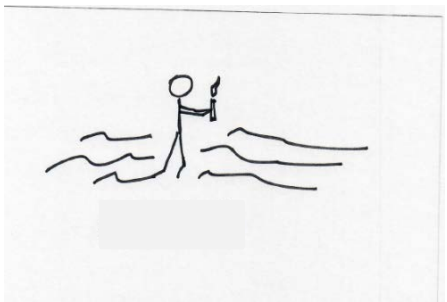

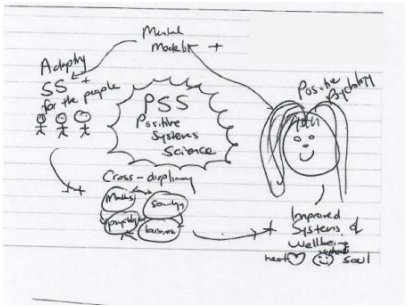

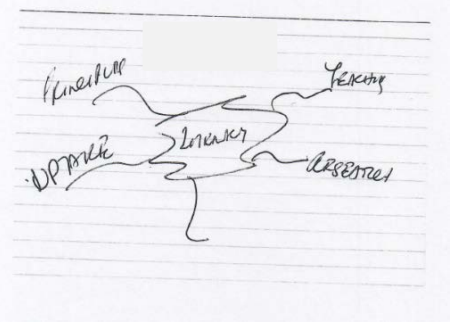

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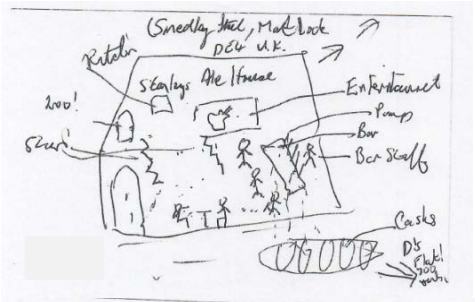
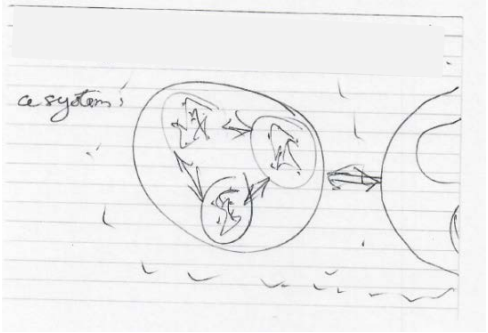
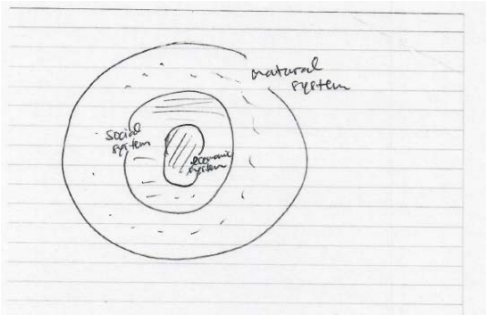
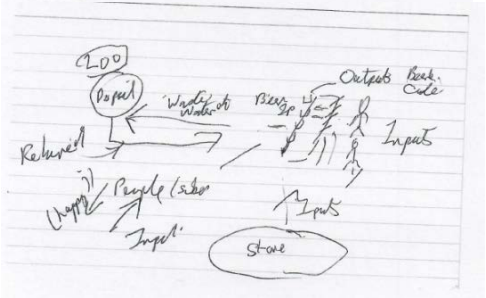
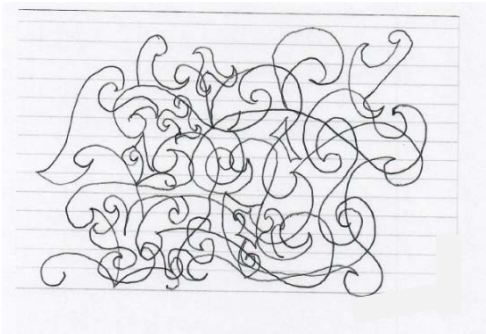
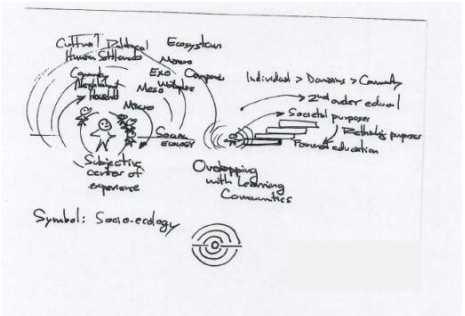










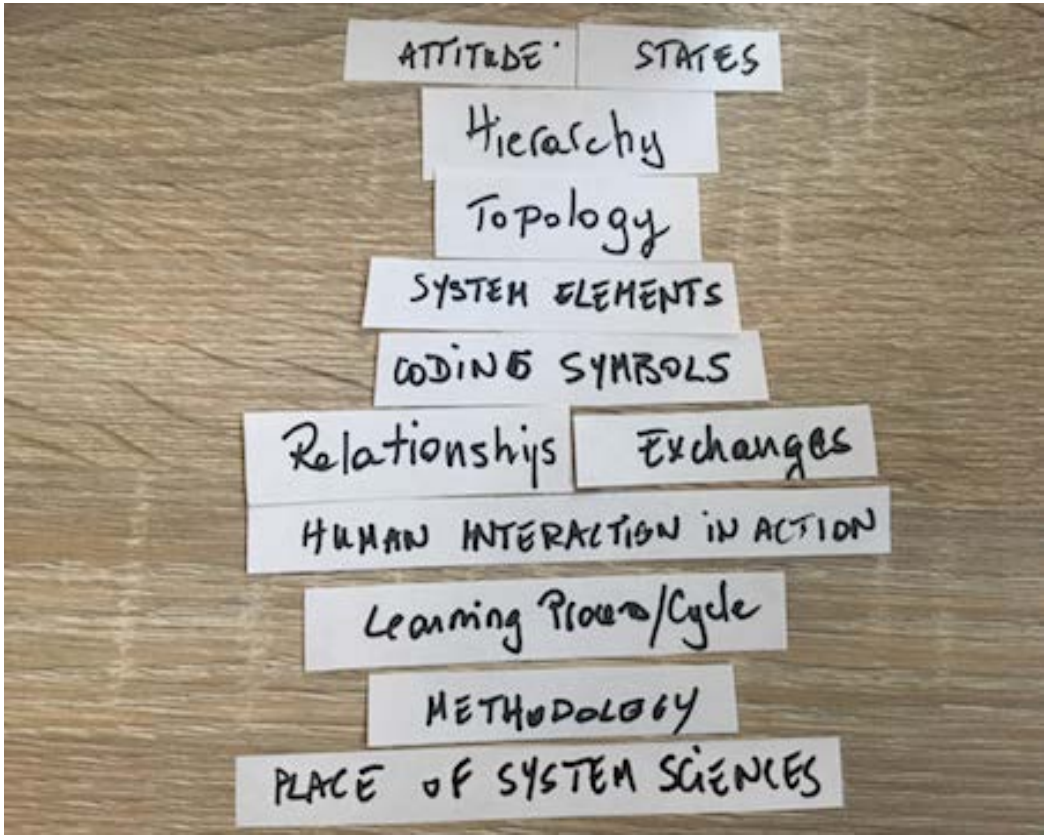


Categorizing

Our harvest shows a diversity of ways of approaching and representing systems.

We tried to categorize

→ There's always something that doesn't fit and needs a new category...



Multiple Frameworks

There are various frameworks that identify, differentiate and encompass multiple variables and perspectives.

Rousseau identifies dozens of sets of heuristic principles (Sillitto, Mobus & Kalton, Hitchkins, Senge referenced in Rousseau 2017)

Other frameworks include: CST frameworks such as Jackson's 'system of systems methodologies' (1987); Midgley's ontological complexity (1992) and systemic intervention (2000) approach; Gregory's discordant pluralism (1996); and Mingers's multimethodology (1997), as well as Derek Cabrera's DSRP model (2015), or Dave Snowden's Cynefin model (Kurtz & Snowden, 2003)

CST= Critical systems thinking

A Pragmatic Approach

Rather than choosing a school of thought and framework for systems literacy, at this stage, or a “lens” through which to see systems, we chose to focus our work on:

- The process of observing / recognizing / differentiating / categorizing / memorizing / practicing / composing / designing
- The enhancement of skills to perform the above across disciplines frameworks and methodologies

→ A pragmatic approach

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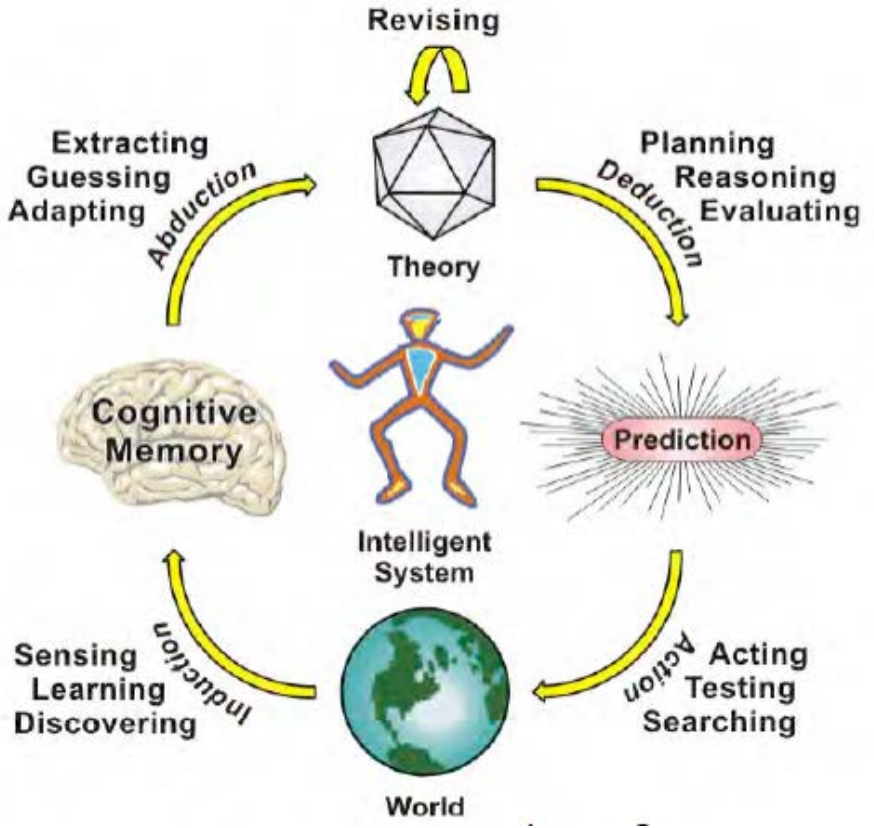
The Pragmatic Cycle

How can Systems Literacy be developed and put into play at every stage or ‘moment’ of the pragmatic cycle?

Image: Peirce’s pragmatic cycle adapted by John Sowa



Education, Learning, Literacy and Action

Let's make a distinction:

- Education = structures, processes & resources for knowledge acquisition
- Learning = process of knowledge acquisition
- Literacy = embodied knowledge which enhances the capacity for action and practice

Literacy, when recognized within a cultural context as an embodied cognition that is a whole-body experience shared within communities, enables or promotes reiterative and hopefully reflective and reflexive actions and practices. (Tuddenham 2017)

Systems Literacy

Working at the level of embodied practical knowledge, enhancing human's "innate systemic sensibility"

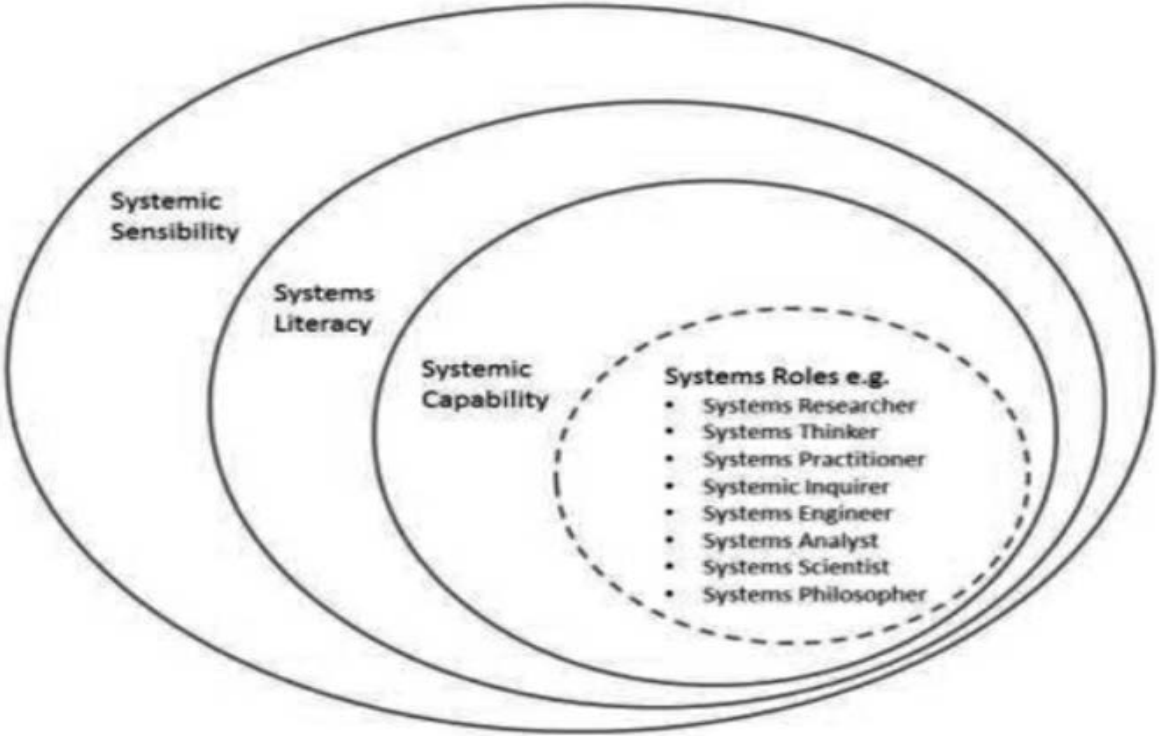
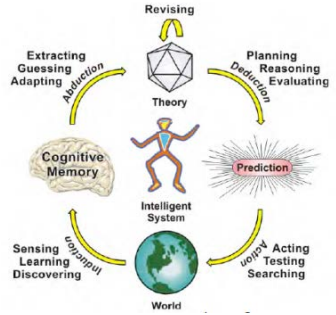
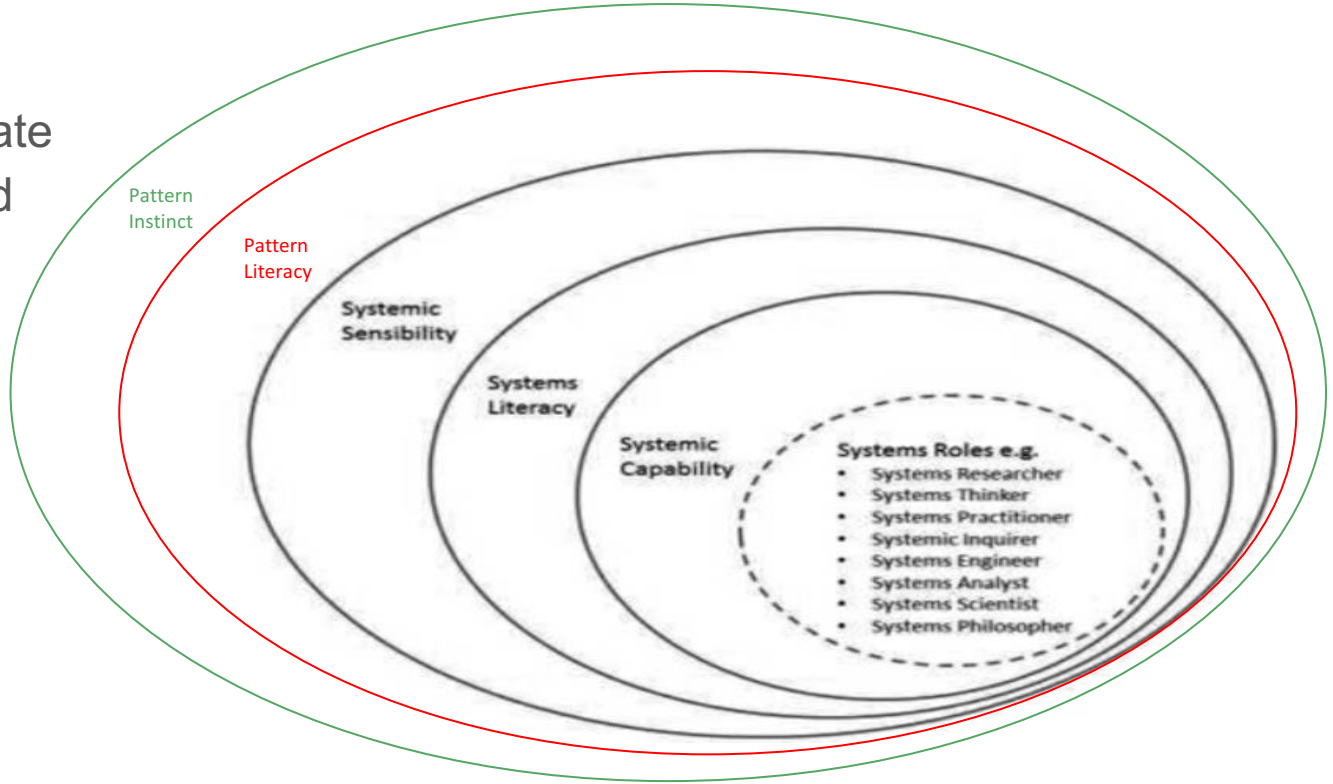


Image: Ray Ison - IFSR 2016

Pattern Literacy

Working at a deeper level of humans' innate ability to process and mobilize patterns at each moment of the pragmatic cycle





Patterns and Systems

Systems have often been described in relation to patterns and cognition:

“A system is a set of things—people, cells, molecules, or whatever — interconnected in such a way that they produce their own pattern of behavior over time.” Donnella Meadows 2008 quoted in Mobus and Kalton 2015

“Our ability to conceptualize a system is thought to be built right into the human brain. We automatically (subconsciously) categorize, note differences and similarities, find patterns, detect interconnections and patterns, and grasp changes over time (dynamics).” Mobus and Kalton 2015

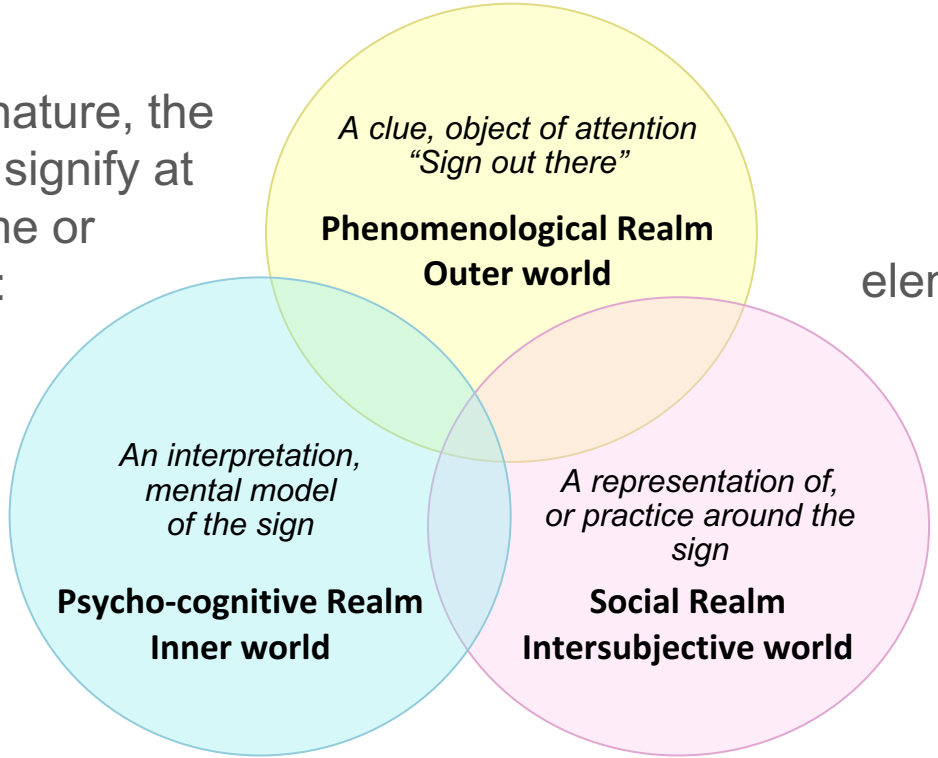
Humans' Patterning Instinct

Patterning 'instinct', analogic thinking, 'pattern-ness' of embodied cognition has been well documented:

- Margolis: patterns are cues in a context, pattern recognition is at the foundation of cognition
- Hofstadter & Sander: human ability to make analogies lies at the root of all conceptualization and the capacity to selectively evoke concepts
- Kurtzweil: the neocortex works as a self-organizing hierarchical system of pattern recognizers
- Andersen: patterns learnt through experience are at the basis of understanding and learning which supports model building

The Pattern, Semiotic and Systemic

Semiotic in nature, the pattern may signify at the same time or alternatively:



Patterns can help connect, at multiple levels of granularity, elements that may seem incommensurable.

They are systemic in nature.

Patterns that Connect

Patterns act as ‘potentially structured’, and scientifically, cognitively and socially recognizable units of meaning.

They are mediators and connectors at boundaries between and among

- Different aspects and levels of systems / ‘dimensions’ of complexity
- Different perspectives and representations and representations
- Cybernetic feedbacks resulting from both observation and practice

Helping to ‘unpack’ the various aspects, levels and dimensions

The Quest For General Systems Principles

In the Quest for General Systems Principles, Rousseau (2017) notes that "although the existence of principles is inferred from the existence of isomorphic systems patterns... knowing more isomorphisms only increases confidence in the existence of principles without making them easier to find."

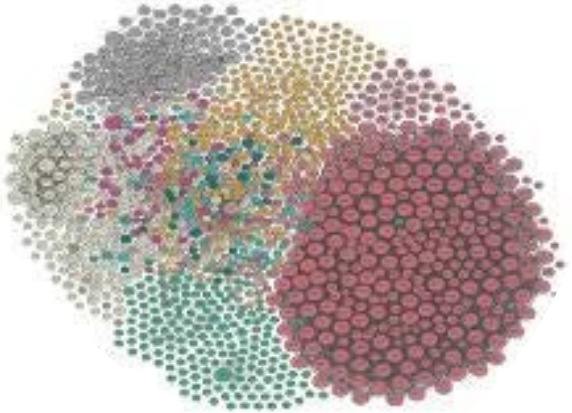
Can we find universal principles or patterns? Many ask, in a context where each researcher is developing his own, with a diversity of interpretations and representations.

A Web of Interconnected Patterns?

The world wide web is born from the unresolved quest to integrate information diversity through single centralized systems and format standards.

It made information inter-operable through the hyperlink and communication protocols.

Isomorphic patterns of multiple nature (in words, image etc…) could be inter-connected via semantic relationships into networks or clusters of linked data, enabling conversations and recording of controversies around system issues and general principles, meta-stabilizing around strong ‘centres’ such as they are now in Wikipedia.



Building Pattern Literacy Roadmap

Work on a ‘theory of patterns” that will orient research and resources towards operationalizing patterns towards pattern literacy and ultimately systems literacy.

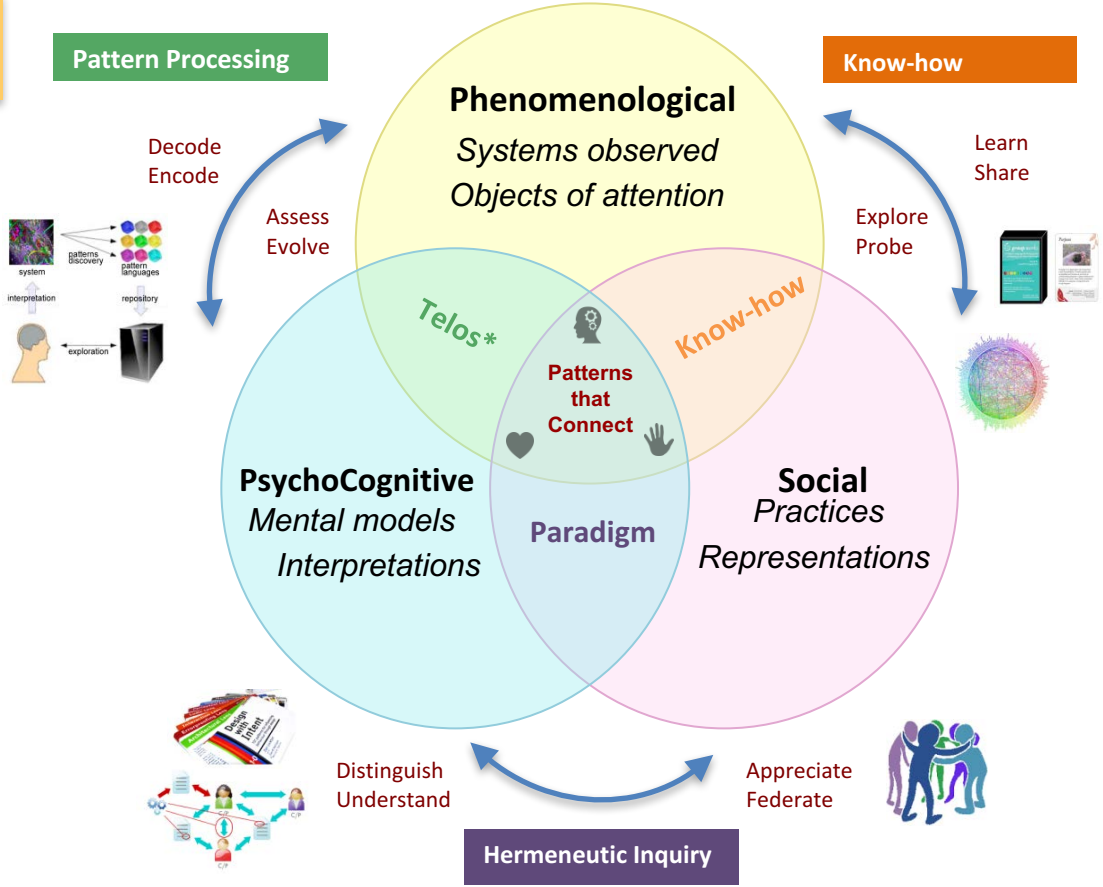
Explore and deliver operationalization requirements and prototypes that can be tested and used in real life projects.

Work on human augmented cognition and communication in connection with the pattern language, systems thinking and systems sciences, as well as the artificial intelligence communities.

Pattern Literacy OS

Building a Pattern Literacy "Operating System" to better discern, look at and collectively interpret what we are observing.

Interconnecting and mediating inner and outer worlds and intersubjectivities, at multiple levels and scales.



Operationalizing Patterns that Connect

To enhance pattern literacy may include:

Visual tools / artifacts - to play, construct, deconstruct, probe
Methods for Participatory Hermeneutical Inquiry
Visual tools to navigate data and knowledge, systems configurations and dynamics

Collaborative sketching and annotation
Semantic capability - the various ways to associate patterns
Formats and protocols for interoperability of patterns
AI deep learning systems to infer / suggest / simulate / play

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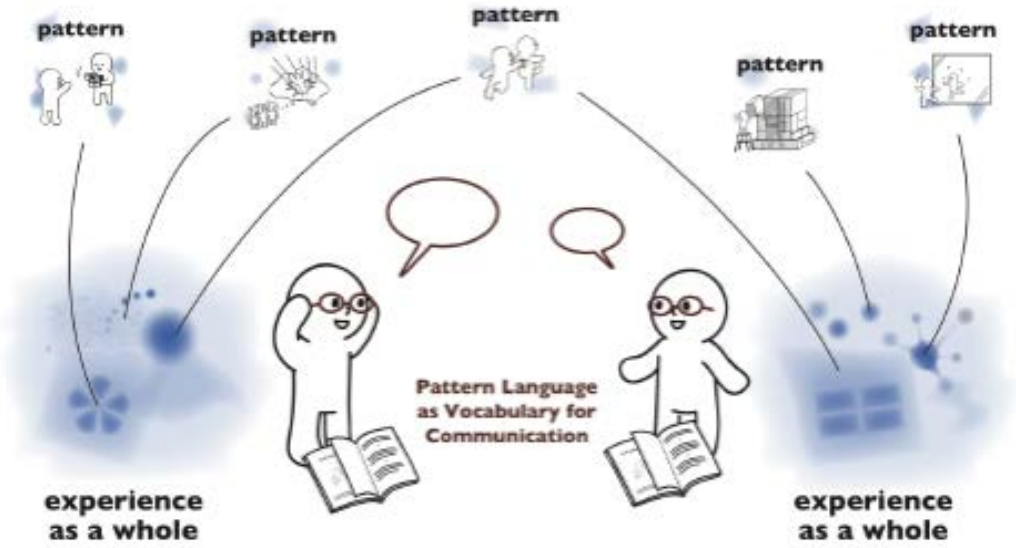
Play - Inquire - Learn

Boundary Objects

Discussing patterns as boundary objects (Bowker & al 2016): Learning at the boundaries, finding interoperability, interfacing diversity.

Here: Exchanging about experience through dialogue via patterns and pattern language (Iba)



Pattern Composition

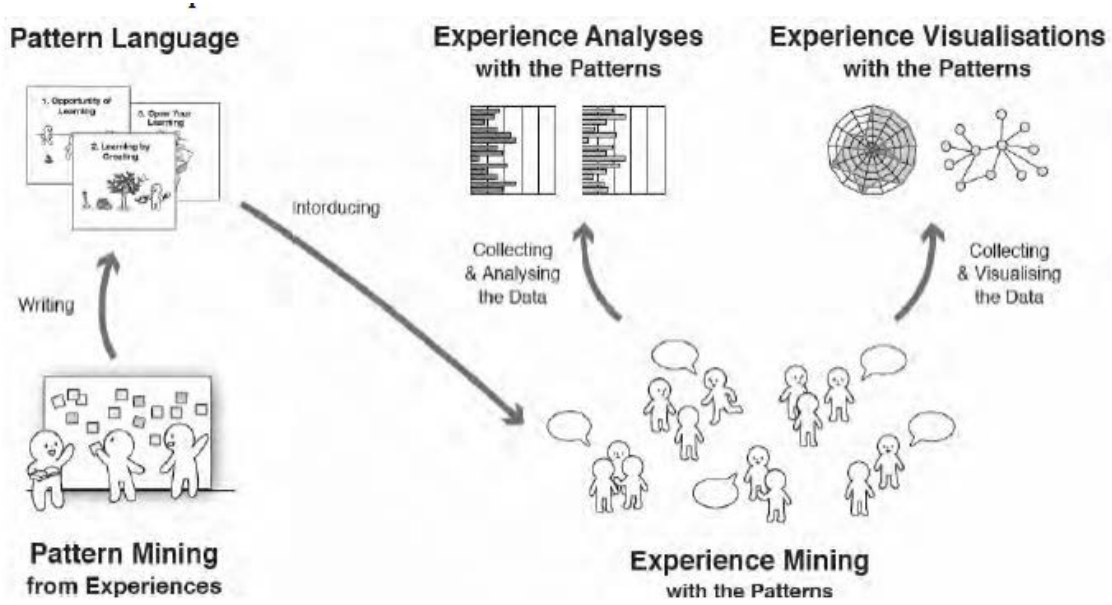
Telling each other systemic stories with patterns as unit of micro-narrative.

Here at Plop 2016, using cards with symbolic representation.

Connecting with Experience

Acquiring new skills for observing & ‘sensing’, for sense-making & [adaptive] modeling

Here: The overview of experience mining, experience analysis and experience visualization with patterns (Iba 2014)



Real Time Learning

Learning to observe our individual and collective thinking as it is happening. Using hermeneutical inquiry (Kinsella 2006) and joint discovery methods to learn together (Johari Window, Luft & Ingham 1955).

Here: Dialogue Workshop with Learning Patterns at Keio University (Iba 2016)

Using Different Kinds of Artifacts

Cards

A Pattern Language for bringing life to meetings and gatherings

http://groupworksdeck.org/

Games and Action

Constructing and deconstructing with our heads and hands. The ‘hacker’s approach

Here: Hands-on construction - Lego Serious Play © - Source Avea Partners.

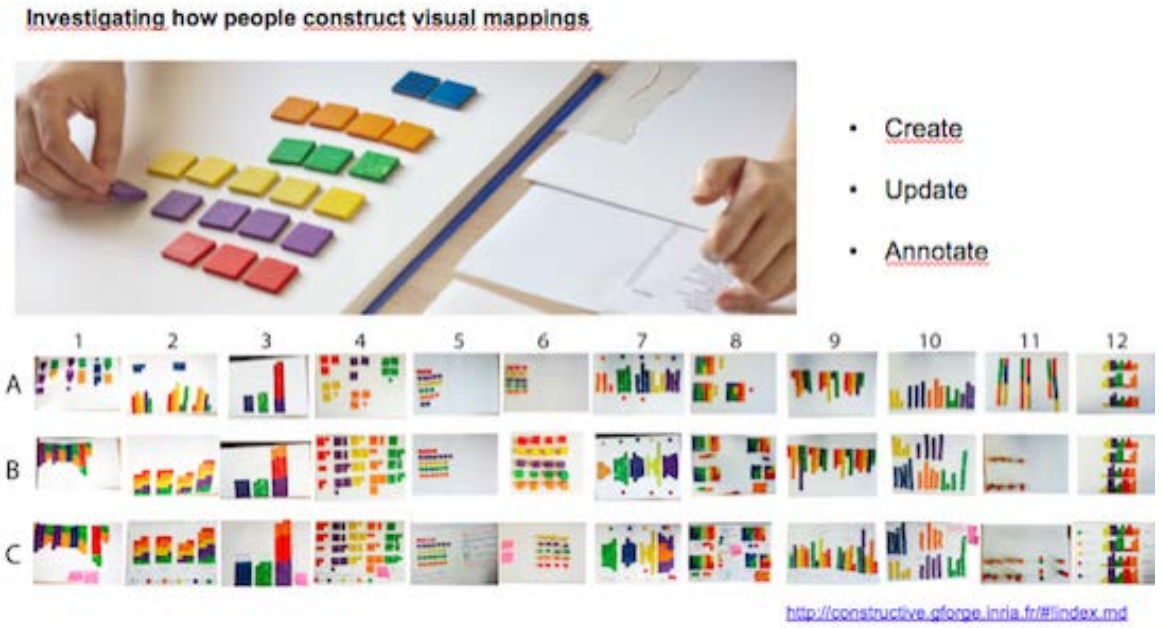
Lego 3D models used a shared language for group discussion, knowledge sharing, problem solving and decision making

- Based on creative imaginations & metaphor
- Learning to ‘think with one’s hands’

Building Visual Systems

Investigating how people create visual representations.

Here: Visual Construction Tools: Tangible Tokens - S. Huron Inria



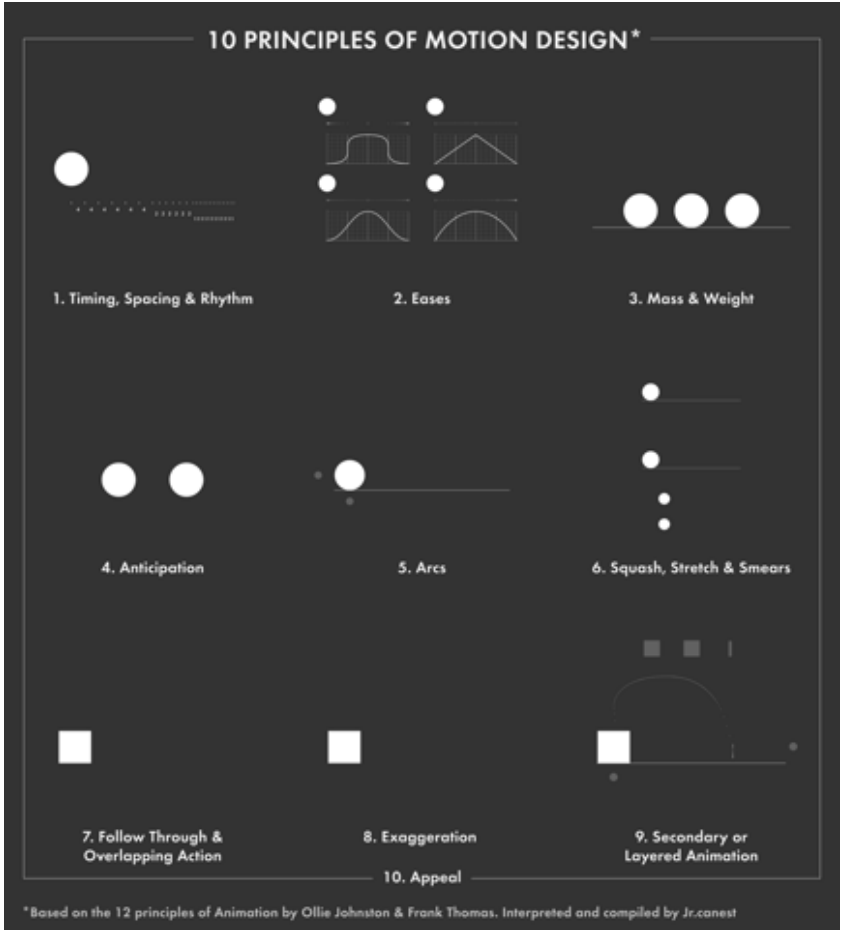
Visualizing Structure & Movement
Individual & Collective

Motion Design

Adapted from the
12 principles of Motion Design
- Ollie Johnson & Frank Thomas

Here several animation patterns (instances) are shown for each principle (category).

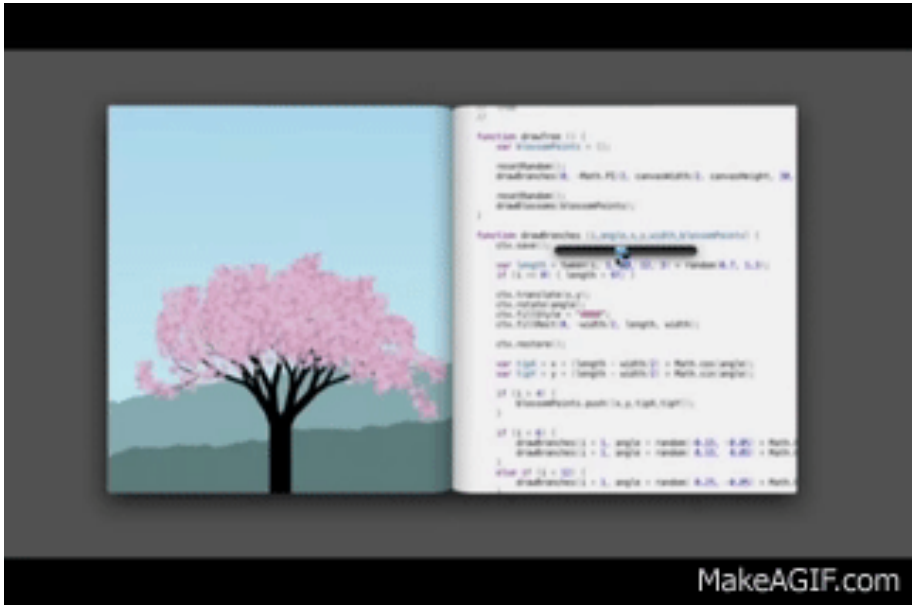
The animation is a composition.



Living presence

Learning to see the picture as it emerges

Here: an illustration of adaptive modeling: Real-time coding feedback. B. Victor



The image moves as the code variables are changed

https://www.youtube.com/watch?v=I8F7tzc1Tco

Emerging Patterns

Seeing the changes, where they are coming from, where they are going, adapting in real time.

Each player draws on a small part of a global mosaic that each can see evolve as they draw

By OlivierAuber - Own work, FAL, http://commons.wikimedia.org/w/index.php?curid=19849563

Emerging Patterns (2)

Gource Visualization:
seeing additions to
software code over time.

Learning via Sensors & Spatial Thinking

An experiment in Canberra.

Using spatial thinking, digital and visual elements to convey complex concepts and increase student understanding and retention.

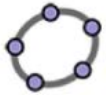
https://www.gizmodo.com.au/2017/06/technology-is-the-key-to-great-stem-teaching/

The tools and resources

The use of applications on Samsung devices promoted high levels of student engagement and supported the teachers' content knowledge for both the primary school and the secondary school programs. Students also drew on the range of sensors built into the Samsung phones, such as the Accelerometer, Barometer, and GPS to capture data, analyse the information and then develop video to creatively highlight their findings.

Primary School

Mandalar is based on pattern blocks which encourage investigation of relationships among shapes and other mathematical concepts. Students used this app to create complex symmetrical patterns.



Geogebra is a dynamic mathematics tool that allows students to visualise and manipulate 2D and 3D mathematical models. Students used this app to visualise the cross sections of 3D shapes.

Origami paper cutting is an open-ended paper engineering app. Students worked collaboratively to create complex designs for their partner to solve, encouraging visualisation.

Secondary School

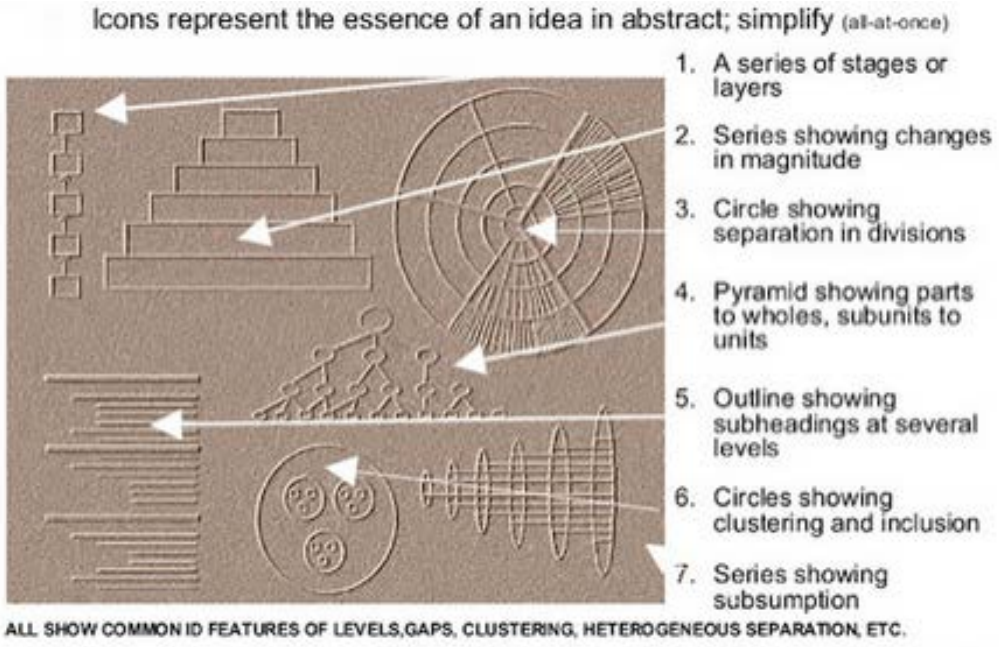
Physics Toolbox Apps provide lesson ideas that require minimal resources, and are relevant to introductory physics in high school. Students from St Clare's College used this app on a rollercoaster ride to capture and analyse the accelerometer data for the trip.

PhoneLabs provides a range of free web apps to help students capture and analyse data with their phones. Year11 students from St Francis Xavier College used this app to measure the speed of sound in air.

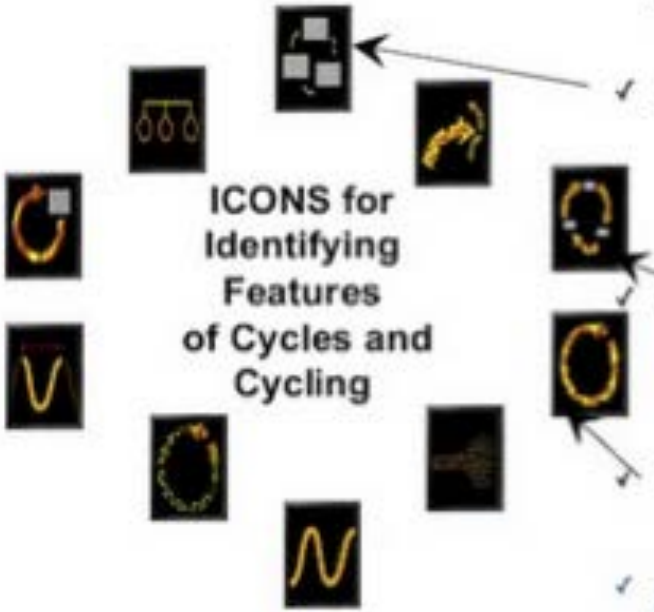
Phonelabs 60X enables students to turn their phone into a microscope and explore everything around them in greater detail. Year 7 students at St Francis Xavier College used this app to investigate the structure of different crystals.

Symbols and Non-verbal Representation Systems

Troncale's Isomorphies: Icons of Hierarchies



Troncale's Isomorphies: Icons of Cycles



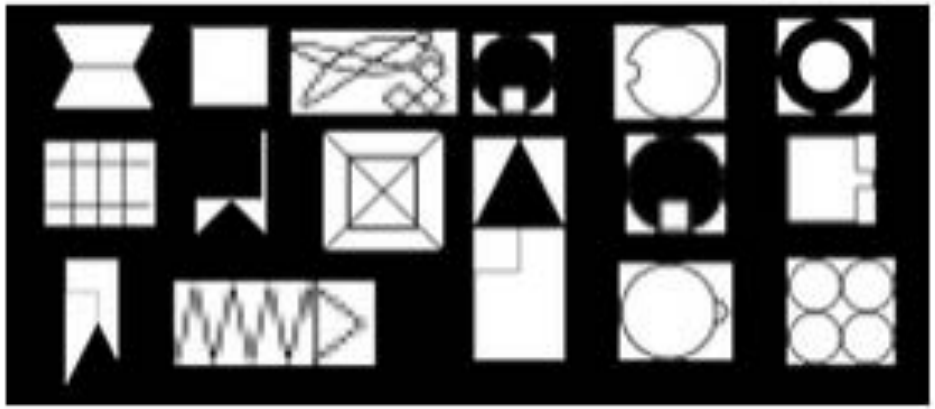
- ✓ From "cyclus" (Gr.) = circle, wheel. Some key features are:
- ✓ Stages of a cycle
  - Steps in a process
  - A cycle may seem like a smooth transition; not very specific intermediates
- ✓ Obligate sequence
  - Transformation of one stage into next
  - Next stage requires previous stage
- ✓ Return to beginning
  - Oscillations
- ✓ SO NEED TO KNOW THE SEQUENCE & STAGE NAMES

Patterns Dynamics™

PatternDynamics™ Matrix Chart

The PatternDynamics Matrix Chart and all Associated Graphics are Trademarks of JamesTimothy Winton.

Ilan Riss' Living Systems Symbols

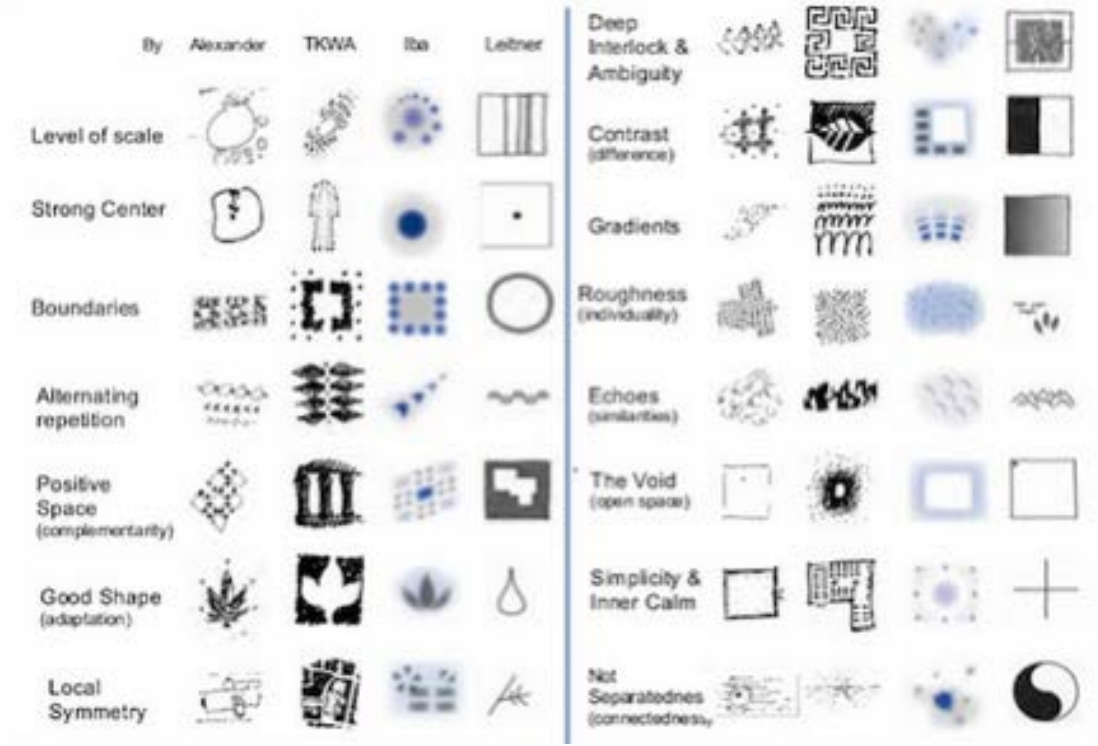


LEGEND of SYSTEMS SYMBOLS and FUNCTIONS

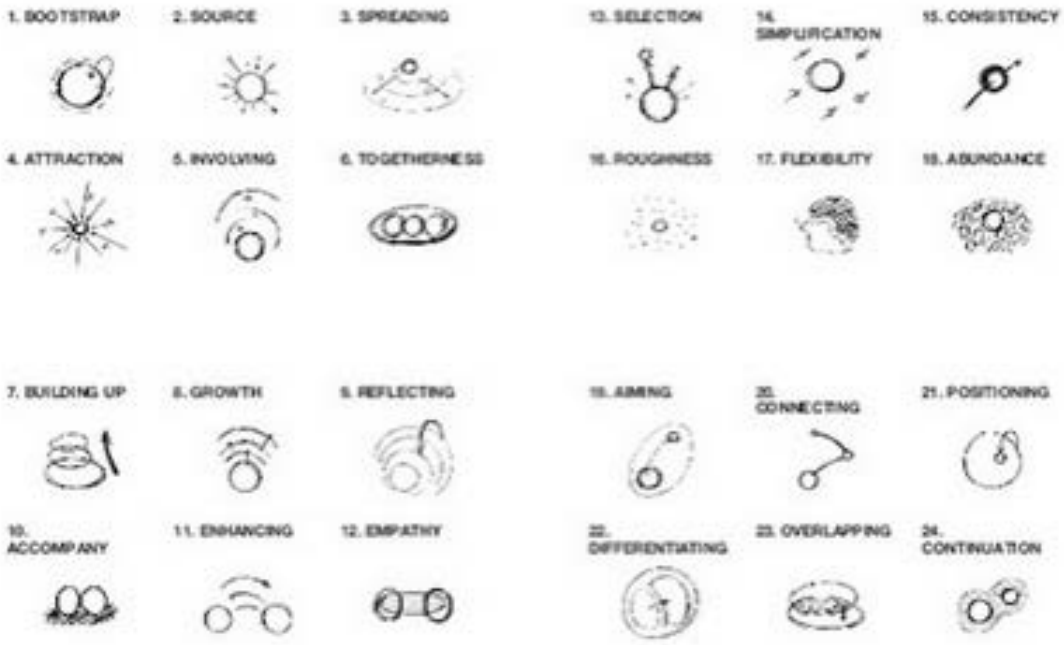
Symbols	Mnemonic shorts		Subsystems (critical)	Functional character features & qualities
△	S	1	Input transducer	sensor, sighting, receptor, detector, perception, receiving
⧖	H	2	Internal transducer	coordination, inside monitor, feeler gage, harmonious correlator, home-base sensing
⧉	D	3	Decoder	diagnose, designation, distinction, interpret, translation, categorize, synoptic labeling, construe, situation-control, identification
✧	P	4	Associator	projective planning, prospect vision, assemble, relate, strategic intelligence, anticipation, presage, decision switch
⬭	G	5	Decider	goals & objectives-keeping, purpose guidance, motives, drive, policy, steering-control, impeller
⋈	N	6	Channel & Net	net (work), communication, circulate, relaying,
⬮	M	7	Memory	remember, message-retainer, filing & retrieval, retrospect
⧉	E	8	Encoder	explicate, external translation, expression-former, outcoding, public report
▽	A	9	Output transducer	action, activator, actuator, exploit, deed, implement, sending, effector,
◷	T	10	Timer	time-keeper, cycle-setter
⋗	J	11	Ingestor	injector, jet-entry, intake, reception, job-entry
⊓	F	12	Supporter	foundation, firmament, ground, substance, sustain, maintain
▱	C	13	Converter	conditioning, prepare, transform, rework, refinery
⋗	K	14	Producer	maker, generator, facture, repair, mending
⊛	Y	15	Motor	move, motility, mobilize, ambulate
⇄	L	16	Distributor	pipeline, transport linkage, route, line entrenchment, liner fairway
◇	Q	17	Storage	supply store, stockpile, queue, cumulation, reservoir, depot, deposit
⊠	X	18	Extruder	exit, outlet, exhaust propulsion, remove, discharge, unload
▭	B	19	Bouncary	border, shield, fence, wall, enclose
◿	Z	20	Reproducer	replicate, template, zoon, remake

Alexander's 15 Principles of Wholeness

4 different representations



Iba's Fundamental Behavioral Properties



Tao and I-Ching

1. Ch'ien (The Creative)
Creative power and energy of the universe.

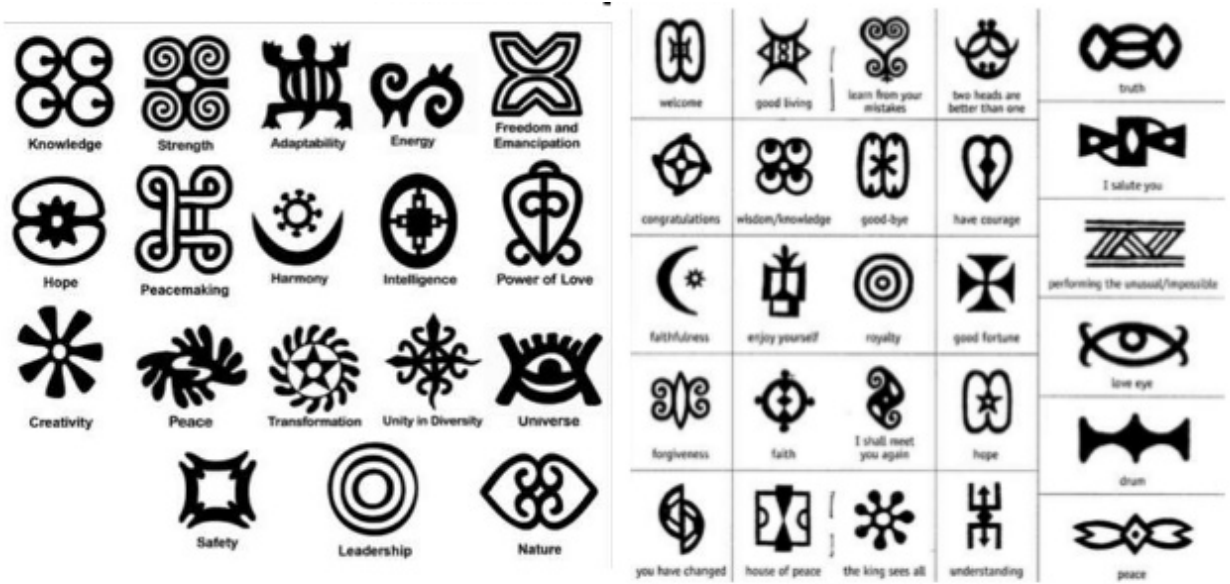
2. K'un (The Receptive)
Involves the feminine part of your self that is gentle and devoted to others.

3. Chun (Difficult Beginnings)
At the beginning of any new venture there is struggle.

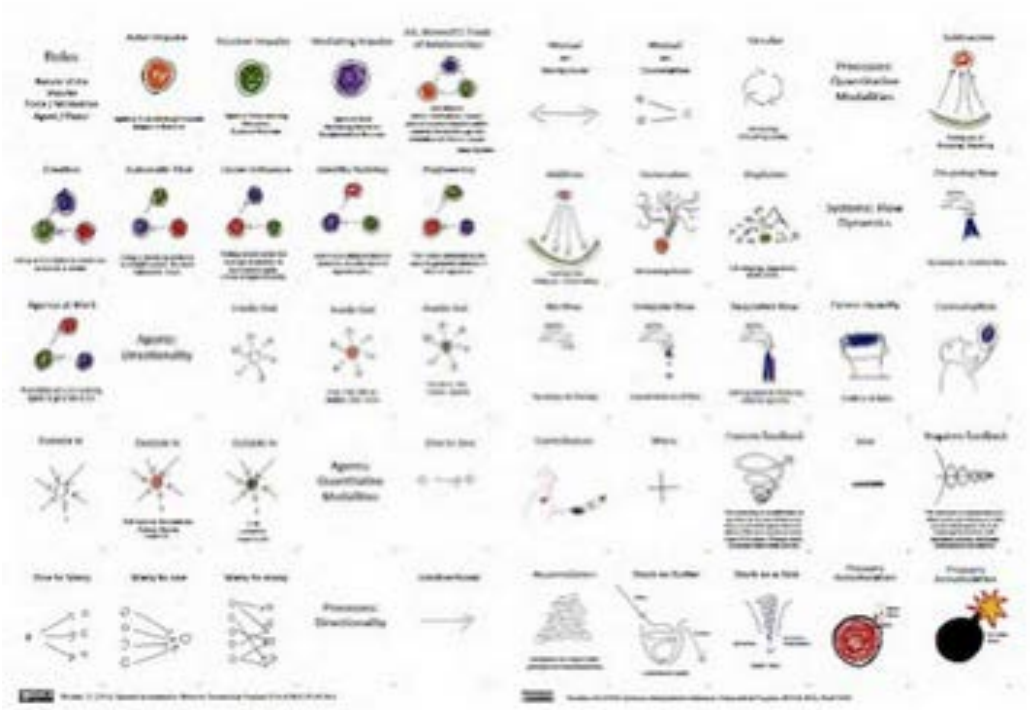
4. Meng (Youthful Folly)
The inability to foresee the consequences of your actions can sometimes lead to disater.

5. Hsu (Waiting)
Certain situations call for immediate action however it is important to know when to wait.

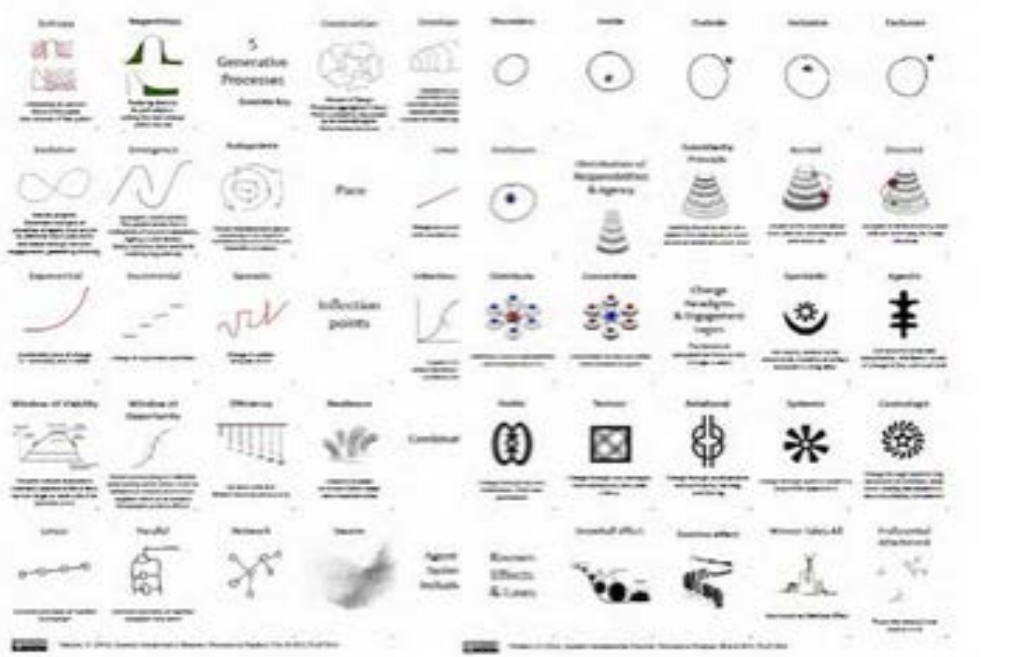
Adinkra Concepts



Finidori's Systemic Interpretation Elements

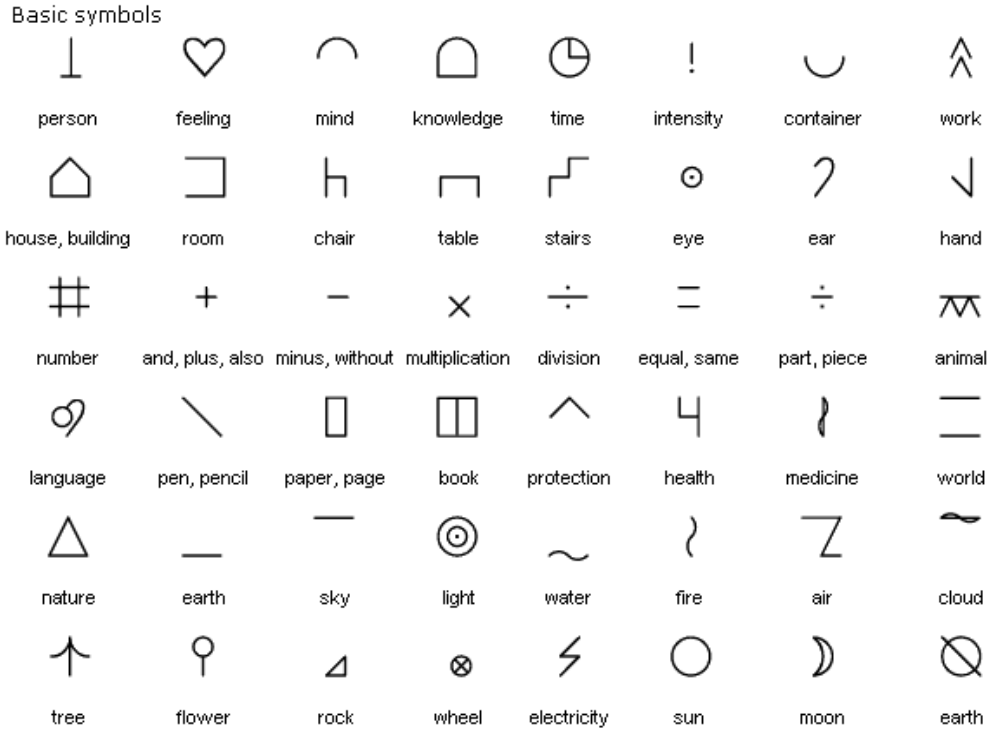


Finidori's Systemic Interpretation Elements 2



Bliss Symbolic

The written equivalent to the language of signs



Thank you

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