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(45 pg Excerpt From Longer Work In Development**)**

Guiding Patterns of Naturally Occurring Design:

A Pattern Language Approach

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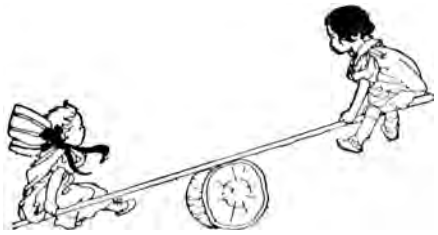

Back and forth, back and forth, engaging with your partner

ABSTRACT (from longer work in development)

Working with "patterns of natural design" is an inverse of working with patterns of "problem" or "solution" design. Common patterns of relationships and forces are found in the context to guide solutions needing to fit. They're patterns that designers, scientists, or others would look for and use to guide their explorations, innovations, healing or repairs. The general teachable patterns guide the discovery of more local and particular patterns and their living qualities in the context being worked with, and in ways to respond to them for fitting design patterns to the natural ones for success. As interventions they prompt a reshaping of the living environment, as others have always done before, producing new living things playing out emerging roles. What Alexander's pattern language model offers is a way to build a general syntax for discussing and using natural patterns of designs. Without that one might refer to the "circles of life" and be understood as making some loose poetic illusion, overlooking their quite material roles clearly seen in how every sort of living organism and culture makes its own home, so as to have a secure domain and retreat, with ready access to the world around it, as a principle pattern of natural design. Practical methods and examples of interest are presented, along with Robert Rosen's modeling of scientific learning as going back and forth between subject and theory, as a pattern for linking other languages with differing perspectives on the same natural things.

Key Words: pattern language, natural patterns, exploration, innovation, healing, translation,

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MAIN BODY

I. INTRODUCTION (from longer work in development)

My recognition of Christopher Alexander's "A Pattern Language" (1977), as a powerful tool for defining and communicating recognized useful recurring elements of design, was curiously belated. Having come to study architecture following a degree in physics, with my own interest in what made such a wide variety of natural processes so lively, and non-deterministic, I was constantly questioning the patterns of change I observed. In architecture school at the Univ. of Pennsylvania GSFA[1] in the early 70's I recall being inspired by some of the things I was introduce to about Alexander's early thinking that fit that curiosity of mine. That was also years before "A Pattern Language" was published, and by that time I'd started a concentrated research on the recognizing the patterns of dynamic evolution by which designs developed over time, and his book wasn't on that. So I didn't notice how closely parallel our work had become, mine focused on universal patterns in how designs developed, and his on defining universal patterns of design intent. I didn't recognize the close connection till recently, in fact, after his pattern language had been translated for use in other fields, and introduced by a friend as something new.

So whether I'm able to convey a smooth way to both expand on Alexander's model for a language of design patterns, using my methods of identifying natural design patterns is the question here. and from their patterns of evolution Then it seemed easy to see the universality of the principles.

[1] GSFA MFA in Archt. & Environmental Design, 2003

The Approach

The principles of pattern language are often stated as by Jan Borchers (2001) saying "a pattern is a proven solution to a recurring design problem", one that "pays special attention to the context in which it is applicable, to the competing forces it needs to balance and to the positive and negative consequences of its application". When thinking about natural design patterns there are some ambiguities in that, like between "the context" is composed of language patterns or material patterns. The tensions created by the need for our semantic worlds of language patterns to connect our actions with our material worlds of natural patterns is, of course, ever-present. We're often not good at articulating it, as that tends to treat everything as in a semantic context.

So my way of approaching those same principles sounds much the same, but employs a "dual paradigm" perspective, of reserving one language for semantic constructs and another for referring to naturally occurring ones. It's nothing we don't already do, but just being a bit more conscious of when we are turning our attention back and forth between what we can identify in naturally occurring designs and what we can say about or construct for ourselves semantically, somewhat like Robert Rosen models the general relation between science and nature (Rosen 2000, Henshaw 2014). To emphasize that "back and forth" between the natural context and the semantic one, I often describe design as a "learning process", as for my 4D Sustainability design cycle (2007a), as the engine of a pattern discovery and adaptation cycle for working within a natural context".

I.  Internal relationship issues - the "design problem"

II.  External relationship issues - the "design context"

III.  Long shots - a search for wider connection

IV.  Total Balance - for adding up all the accounts

We can also look at this in the terms of the 27 statements of principle in the "Detailed Table of Contents" Alexander offered in "The Timeless Way of Building" (1979). His final principle, titled "The Kernel of the Way", saying "this ageless character [of living quality] has nothing to do with languages. The language, and the processes which stem from it, merely release the fundamental order which is native to us." That also speaks of a dual paradigm, and the language used just releasing a native order. A simpler analogy would be that of using the language as a scaffold, for releasing a building process not controlled by it, and then removing the scaffold.

The idea can be rounded out a bit more using some ideas from Lou Kahn's rather similar thinking about the problem, his speaking eloquently a design as looking for its own identity, as "what it wants to be", and the need for the architect to reach beyond all writing for the answers, in saying that all design comes from "reading book zero". It may feel like a strange use of terminology, but it's also clear that buildings and their cultures also do in fact, just as businesses and their social cultures do as well, become kinds of autonomous entities with lives of their own, So, the "kernel" is that IF the right ingredients are there when the scaffold comes down, the living entity that is growing there will become a vital and thriving thing on its own. If not it may be hampered by conflict or neglect, which does indeed all seem to depend on someone caring enough to bring the right ingredients together.

So, as to the approach of this essay, it's a "collection of ingredients", grouped in five general categories:

> Homes and Transformations, Recognizing Natural Patterns, Language for Natural Patterns, More Complex Homes, More Complex Transformations, Related Study Cards

It's important to notice how this approach differs from other pattern finding and using approaches too. It's really for learning how to recognize the patterns that nature demonstrates versatile ways of *building with*, not to find "rules of design" that nature seems to follow. The use of these patterns is for raising better questions in future situations, and finding greater freedom in exploring how things work. So the aim is to help with tapping the rich resources of the natural context, using the design patterns we can clearly describe to expose how they are or might be employed in other circumstances. We use our well spoken words for one thing as a lens for more clearly viewing others, opening our own way of learning about always more complex living relationships.

Learning to recognize, describe and use natural patterns for either design or exploring systems embodying them is like any other learning, much faster if following study with application. So just as a general suggestion for better understanding the natural patterns identified are really about here's a model exercise to try or alter. For any new pattern, or when you come across it again too perhaps, you might try to 1) think of two or three examples from your own experience, 2) try to define them in those contexts, and 3) look at a day later, or see if someone else studying this approach understands of the ones that matter to you, and 4) think making an edit.

One Starting Point

While still in architecture school in the early 70's I do recall Alexander providing an important inspiration for my later work, by way of what I now presume was a class or a lecture. It was on his early insight into how the design of the Piazza San Marco went through several changes over time that relied on its urban environment serving as an evolutionary memory recording echoes of prior changes lost[2]. It seemed to show that environmental memory for elements lost,

[2] Alexander seems not to have published the work till many years later (2006)

enabled them to be restored later with updated versions. It's not so surprising, really, that if one generation removes something that prior generations had liked, that the fabric of the city might contain reminders of a lost purpose of the city that needed to be restored when it became possible.

The idea that the repercussions of change in how people used their environment might themselves leave a permanent record of all past changes still seemed like a very daringly if also obvious possibility. To someone who had been noticing patterns of evolving change and wondering how they might appear to follow directions of their own, it fit right in. So I began to think about whether historical artifacts might offer reminders of discarded options from the past. Of course as soon as I asked the question I began noticing the clear effect of that in how my own and everyone else's design projects evolved on their drawing boards. Whatever is erased still leaves patterns reflecting having been in the design, usually to the very end. So the implication is that not only do things of the future have to build on the past, they also have environmental memories of what is removed in the past to inform later additions, however they may be made, as well. That really enriches the picture of how accumulative designs always reflect an environment of change.

There were two particularly exciting natural patterns that jumped out at me, though at the time I might have had difficulty describing them.

a. A natural sequence of design, in how the designs develop by the same stages of increasing complexity an difficulty every time, 1) collecting and sorting information as you search for a beginning b) studying alternate designs for function and appearance c) doing initial design for all the working systems for a selected alternate, d) confirming the feasibility of all parts the design and systems working together, e) developing the drawings and details that would let someone accurately estimate the cost and carry out

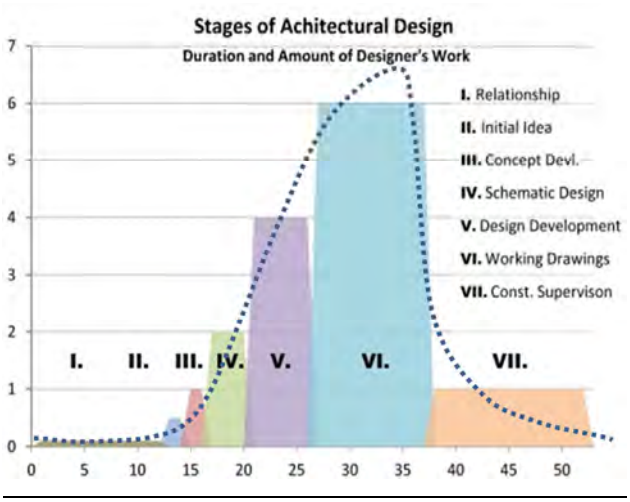
the work. Those are the "concept", "schematic", "development" and "working documents" phases, a strenuous learning process progressing from easy to intensely demanding as the design process generates a framework and then fills in the details.

b. A mental process of leading to a sometimes fluid state of thinking about all the alternatives ever discovered at once, allowing small changes one place to ripple through a design as part of an integrated whole. At every stage the alternatives for more detailed ideas repeatedly test the basic ideas, and the intensity of the work tends to eliminate all distraction, so as designs progress designers tend to remember all their discarded experiments and how the discards also informed the retained ones, a kind of deep "environmental memory" guiding the development of the elements kept, that might in a way get simpler and simpler over time.

I've come to see these two patterns as reflecting a true universal pattern of natural stages of organizational design, different in every case of the same universal form, whether considering human designs or natural processes of growth and formation of environmental organization and natural capital. As an economy invents a new technology, for example, a great deal of experimentation with "proof of concept" ideas occurs all along the way, from inception through establishing the framework ideas and environmental infrastructures. So as the new forms emerge there are still scraps lying around of both the thinking and the devices associated with the wide diversity of experiments.

The Natural Stages of Design

Stages of Design with Increasing Effort



1. The general pattern of design

One of the other patterns of design I first noticed in the course of watching how our designs progressed in the studio was a very predictable repeating succession of stages of design more or less just like forest succession works in nature. In evolving from a barren landscape to a climax state a forest goes through stages similar to those of any other kind of complex system design, an industrial product as well, maybe described as going through stages of "hypothetical", "infant", "immature", "adolescent" and then "mature" and "fully realized" design. Figure 2. is a diagram showing the usual shape of the workload of an typical architectural office project as it swells and subsides over the course of yearlong design and construction process. Product development cycles would show similar stages, as well as other project development and decision making processes of all kinds, beginning with searching for something to build then building it, with a crunch of getting the details right at the end.

I.	**New Client Relationship**	Getting to know the client
II.	**Initial Idea**	Having the initial idea
III.	**Conceptual Designs**	Exploring alternate concepts
IV.	**Schematic Design**	Proving one for serving the need
V.	**Design Development**	Proving feasibility of building systems,
VI.	**Working Documents**	Details for builders to price and build it
VII.	**Construction Observation**	Watching over it as it is built

Table 1. Normal work stages of an architectural office project

The dotted line shows a likely curve of actual office expenses for completing the job. A design studio project might only take four or six weeks rather than , but student work follow a similar succession of types and scales of design effort, except for the review after the series of all-night crash efforts to finish on time being to sit and learn from the discussion of everyone's work. That this is also fairly typical as an example of a quite universal pattern throughout nature, as well as for projects in the office, for the series of "bootstrap" stages and escalating energy expenditures required, to start from scratch and by accumulative steps develop any kind of complete organized system that works as a whole, became the starting point of for all my later interests in how different kinds of organization in nature went through stages of changing how they worked as they developed.

What we see in this general pattern of design is how every design follows natural steps of development, steps in accumulating organization that serve as:

- a the design's "natural capital" for continuing with the rest of the design process,
- a series of structures on which the next stage of design can be added,
- it's environmental memory of work done.

As a natural pattern of natural pattern the accumulative building it makes design a progressive evolutionary process. Forty years ago as I started trying to describe it as a general pattern, I found other architects and designers discussing it in terms of their own work, but not as a common general pattern in the nature of design, both for both human and natural systems. When I went to talk to scientists in various fields, who might think about more general patterns of nature, what I found seemed to be was a total lack of any language for discussing them, the language of science being for describing deterministic processes and patterns of unguided development really only possible to discuss as autonomous processes. That discovery was made in the late 70's, and now I of course certainly wish I'd remembered that

Alexander had made remarkable observations about autonomous processes of environmental design. I didn't see them in his book on architectural design patterns, though, so his methods didn't seem to help with what I needed.

Beginnings of a Language

This way of identifying universal patterns of design, started from recognizing universal invariants in shape, in the flowing processes of natural design processes, and in how natural transitions generally have graduated shapes, "S" curves, that correspond directly to the naturally occurring systems that form them. Later work identified a general physics of continuity in transformational shape, pattern invariants in growth, and algorithms that could identify those shapes in nature (Henshaw 1979, 1999, 2010b). Only one of those references is published in an edited technical journal, as the work also exposed a problem of broad omissions in the languages available to discuss what these pattern invariants come from. The problem was and is that the sciences, and our culture in general, have a distinct lack of terms and ways of discussing naturally occurring autonomous systems as subjects, a large "blind spot". That's what these shape pattern invariants was letting me study. They are particularly useful for identifying out-of-control and potentially disruptive emerging system in time to respond to them is needed.

The absence of a language came out most oddly when I found if you talked to people about anything outside their experience, they would fill in a some familiar interpretation, and so not prompt any questions, like I'd stepped into "The Twilight Zone". Eventually I found that people actually change their formal rules of language many times a day, for each "silo of relationships" they are part of. You'd have one way of thinking and speaking at the office, another to academic peers, others with family, at church or with friends, and still others with different community groups and in online chat rooms. How move between our many distinct silos of

thinking displays a great "miss-mash" of inconsistency, from one to another, that we take so much for granted as if unaware, but also expertly manage, keeping them separate and almost never getting caught mixing them up. So it must be very natural.

The Emergence Pattern of Pattern Language

2. Growth of Pattern Language

The pattern I finally recognized to help with what to do was noticing how relatively easy it was to discuss interesting patterns of natural behavior and ideas about autonomous systems, when talking with most anyone at the bus stop. The bus stop seemed like a sort of a "silo free zone", where no one spoke with one of their many private languages, just their natural language. I had needed to find a common language in which the words could take on the meanings of what they referred to in the natural world. That's what natural language serves us wonderfully for, but gets put aside whenever we switch to any of our numerous private languages. It's also a natural property of Alexander's pattern language, set up to refer to commonly recognized patterns of design, for people to recognize a natural resources, for both understanding and working in the commons of all patterns.

So in this regard, I think the current emergence of "pattern language" represents a historic innovation in language, that will change how people visualize the world, how we share the meanings of life. I see it as offering a solid bridge between our two previously separated worlds, our awareness of the natural world in which we live and our conceptual world in which we make up our own definitions for words and stories. We actually seem to be coming toward the end of a nominally 5000 year cultural experience of constantly struggling to

understand the world in terms of conceptual rules and deterministic organizations, for expanding our control over each other and everything we could master on earth. Having now made our control systems on earth so successful their interactions at the limits of the earth have then become largely unmanageable, offering a natural motivation for finding a pattern language to help more clearly define the life questions and working relationships being we have to deal with, in a way more grounded in what is commonly observable.

The key difference between the use of pattern language and other languages is in how it both allows and requires you to give names to recognized recurrent design patterns in the complex systems of relationships our world is made of and we need to see how to work with. That then rewards you with a new kind of bridge between our semantic and experiential worlds. It provides a careful way to attach words to recognized working patterns of life, defining the words we use by association with them. That makes it a kind of scientific systems thinking, not founded on abstract definitions, but one still retaining the ability to refer directly to the recognizable parts of the complex natural world system designs under discussion. The catch, in the view of some, is then being required to not just say your definitions of words come from some recognizable patterns, but also to offer a way for others to confirm and broaden the meanings from their perspectives of the observable pattern.

So pattern language has that added task, that of referring others to ways of making observations to confirm the essence of the stated meanings, and enlarge of adjust them. If what a described design pattern refers to was interpreted as more of a personal observation, rather than a truly recurrent and useful natural design pattern, others won't be able to confirm it. For example, management consultants may be heard saying "smart sounding" things, that are only useful if validated by the experience of the audience. Seddon (2008) is known for saying "studying the system is what makes it work", sounding to some to seem

"mysterious" perhaps. If you check to verify that as describing a design pattern, it will seem to mean precisely what is said. It's only people who study the systems they work with that learn enough to work with them, applying to organizations too.

II. NATURAL PATTERNS OF HOMES (from longer work in development)

Like getting to know a new town, when we study natural patterns you at first explore some of their neighborhoods, before getting into details. Patterns of natural design affect our lives and choices, like the shifts in what relationships will work from one business or culture of family, to another. Each has its own set of relationship patterns, that might well affect our lives and choices. You can also think of them as affecting the choices of others, and for people from different walks of life or ages, or differently in different seasons. Those are all "neighborhoods" of natural designs and their patterns. Then you can consider any of those as organic system patterns of material relations, as well as many other kinds, aesthetic, political, financial… it looks like it could get bewildering.

That's where the whole system view helps, that of natural systems very often found to have individual autonomy, a unique whole that can be looked at in all those different ways. Our own lives are the center of a whole network of relationships, external and internal principally. You can say the same for any life, that the evolution of its designs and relationships from some small beginning to its end is a whole. It's also a "home" for the zones of its internal relationships, and base of operations for its external relationships, and the semi-permeable perimeter separating them its exterior.

Taken together these views broaden the meaning of the identifiable patterns you will find, giving them context, making it easier to discover what makes them either versatile and welcoming or unlikely to be, rich or poor in living quality. When we describe patterns based

on such wide ranging thought the task is that of finding simple terms that are naturally clear and suggestive for the essence of the pattern and the richness of its world. You hope to identify what it is about the pattern that has some set of effects, that lets you understand it individually, as part of the nature of the place and circumstance in which you find it, and a possible model of the same elements one might find elsewhere.

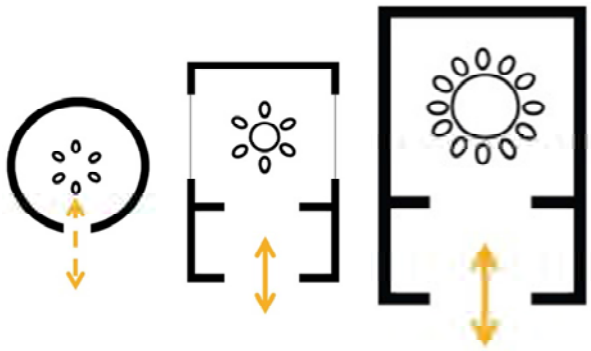
So, to do the exercise, what comes to mind when we think of the stories of 'homes', well mostly the human experiences of homes of course, though every kind of living culture is a home of its kind. We remember from early childhood the homes made for our own or another child's toys, as places to fantasize a world of unto itself. In our homes we make places that are the homes for other activities, each corner of the house often a home for something else, each side of the yard. There are the neighborhoods that are the homes in each town for each separate community that establishes itself, both mixing and maintaining separations, according to their interactions with others, each "side" of town often speaking almost a different language within its bounds as to 'others'. There are the homes that groups of friends make, in the neighborhoods of every town, or their school classes, or in their place of work, some groups seeing the whole territory as their homes, others seeing just their exclusive zone. The sighting of any house is itself a task of giving it an autonomous place anyone who lives there will make their home.

Most personal to us are the homes of our families as wholes, the whole place and the commonality of what happens there, generally as places of truly equitable sharing, Most often homes are places of warmth, that kindle something of their own flame, and if a happy home bringing a highly individualized glow to the lives everyone who has the privilege of being accepted in them for however long. This same kind of exploration of how the natural well-working essentials of homes as natural centers of environmental organization can of course be

repeated with the particular dysfunctions that arise. Two of the most important to consider today are how homes work when for people forming either family or community homes without sharing common cultures of origin. A more hidden dilemma today is for the exchange of trusts as products are traded between homes, the smile and thank-you when passing on the tokens and getting the products in any exchange of money for goods or services. It's needed for conveying the confidence of the rightness of the exchange between the parties in the common home of their larger culture. With the information on what is actually done around the world to deliver goods impossible to record or convey, and the assurance of good intent in the smile during exchange the only protection from demands for delivering ever more with ever less departing from the common interest, the original collective responsibility relied on can evaporate, just as either real or symbolic "bricks without straw".

Elemental forms of "Homes"

Circle Family Community



3. Shelters for Equitable Relationships

Homes are enclosures where good access to the world around them, but where the users can define their own ways of living, free of outside interference, so "places for autonomous systems of relationships.

A biological cell is also an autonomous organism, with its internal operations largely sheltered from outside exposure, except for selectively controlled exchanges. It would be hard to count the differences between the autonomous relationships a cell develops to let it work smoothly, and that a family does, or a community, of course . There are distinct similarities though, like that at the center of the biological cell is its nucleus, and the work of the cell is

organized around that somehow, the nucleus might even serve as a kind of map of the common culture of all the cells of the body.

Serving as the center for a family home is usually the kitchen or dining room table, not a central repository of information, but an open space, across which family members share a common culture. Each person maintains their own mental image of the culture the family lives in and in the family circle each person has the attention of all the others, and witnesses all the communication between the others, for a self-reinforcing commonality of experience. That's not really possible except when gathered around an opening that both separates and holds a group of people together collectively. Much the same relationship exists when sitting around a camp fire, that the fire brings people together and holds them apart, giving each person an equal audience with every other.

How strong an unique a bond that naturally creates is not appreciated until you experience how the complete privacy of homes allows families to organized themselves in very different ways. What becomes the general rule to expect is that homes are made to contain internal worlds of relationships that are most often quite complex and uniquely individual. Even though it's family cultures are literally invisible to others who don't participate in them somehow, we come to expect that any home contains an inner world we know very little about whenever approaching from outside. As outside observers all we initially recognize is the signs of the enclosure, that tells us little of what's inside. Unexpectedly often we'll find we cross a boundary not even realizing there *was* an inside, only finding we have entered someone else's domain by realizing we don't quite know how to act.

It might be only after considerable study after recognizing some boundary and discover what it hides from view is some very different kind of organization than we're familiar with. It may look familiar on the outside, only to be found very different from what we'd expect on the

inside. We recognize a boundary as our information, a house or a group of friends that keeps to itself, a consistent shape that separates something inside from outside. Conveying no hint of why there are also openings in the boundary, it may only be much later that we recognize them as allowing things inside to connect, their internal and external relationships. We may be walking down a street and see through a window some family having dinner, but have no way to understand it. Think about it physiologically. Those relationships you're watching are between the people relating to each other. They are not between the bits of information you can observe. So the two information contexts remain entirely disconnected even open to view.

As children we first find other people's homes deeply mysterious, the homes of neighbors and relatives, full of special things that wouldn't make sense in our own, surprising us in how they live. As adults we frequently have new employees, new roommates, new partners, and of course new children who all surprise us by having such original lives and minds of their own. The first impression we get from the outside takes a long time to reshape for both the amazing talents as well as the upsetting complaints they often have hidden inside. Every culture is a "cult" in that way too, a way of life deeply embedded with ancient manners and practices, the subtle character of which may be hugely important internally, but to any outside observer would have too little context to even be recognized as meaningful at all.

As a result many of us if not most, find ourselves living somewhat "invisible lives", as what makes private lives so private in many ways is rather universal. We may also have grown up in one of the many more or less unnamed and so unknown "invisible cultures", that outsiders never seem to understand. So it's in the nature of homes to be private, for cultures to be initially at least invisible too, the complex of working internal relationships not to be understood except to participants, private both physically and organizationally. It keeps outsiders from understanding the meaning of even what is easily observed, until we take an

interest in the why we all live such hidden lives and build a deep compost pile of observations about it to call up in new situations.

Perceiving the Home We Live In

To briefly consider the bigger problems for perception that arise, before returning to our subject of pattern recognition again, consider how the complex way of living that develops in private homes may be clearly recognizable, but not really understood even by the participants. They may have clear bounds, but also exist as an organic whole, with deep cultural history within complex social contexts, with every little feature of each personality having its own place in the whole. The bigger problem arises with our having the same problem with understanding human minds, our own or anyone else's. Our minds develop their own complex internal world of relationships that are hidden from the outside, that we also can't quite understand ourselves as participants. It's a stubborn "lack of grounding" for all perception, leading naturally to our not quite knowing what we're doing in general. That in turn presents a need for finding more reliable guiding patterns of life, when possible, to help us find more secure ways of understanding.

Over the centuries how people understand the patterns of life has confusingly divided our ways of thinking between a focus on patterns of information we have, and recognizing the living systems identified in the patterns of information we haven't. What let me begin to study this was recognizing interesting patterns in how we alternate. To live in the modern world we find many conversations seeming to switch back and forth, between using perceptions controlled entirely by "appearances" (the information we have) and "relationships" (we are led to by hints of information we haven't). It appears possible for it to work fine, except for the traditions of deterministic, theoretical and authoritarian thinking that become so reliant on their own abstracted meanings for the data used to represent the world, they lack relevant

questions about the worlds of natural organization, quite evident all around us, they have no data on.

The question is whether it would be helpful to know we live in this kind of world, full of deep secrets, because nature works that way. Would knowing how to recognize the signs of our acting toward others as if completely blind to what is meaningful to them be of any help, as for solving the great culture clashes that erupt all the time. It's a fairly universal difference between the insides and outsides of things, that all kinds of homes, on every scale, are defined by the common culture they develop internally, that takes place only within their domains, and so only has much meaning there. That's pretty disappointing to most people. It certainly has been to me time and again, that the way of living we grow up to cherish in our homes, just don't have the same meaning elsewhere. "Elsewhere" is still a wilderness, still an endless search for the values and practices that will give it working relationships work, and become whole.

It takes learning, of course, to recognize patterns in what does not appear as information to our senses to be perceptible at all… until one has built up a considerable life experience with recognizing lots of kinds of signs and signals of "what's happening". That would include the great variety of social movements as well ecological eruptions and disruptions, that we see as "emergent" but appear to be "emerging" from nothing at all. That's not the case of course. They are just developing organically in the normal way by the building of complex relationships naturally hidden from view, except in the patterns one notices of "something happening", that take a real effort to begin to understand as each and every one seems to be individually original and independent in origin. Educating ourselves to do that is perhaps about the last interest of the parts of society that became organized around using determined information about wealth and power to control ever more information. Learning to recognize

the worlds of organic systems our lives depend on, but are naturally somewhat hidden from view, is what habits of deterministic thinking, that seem to naturally come to control the hierarchical structures of wealth and .

It appears this tension arises from a real ancient break in human cultural traditions, an apparent historical "great transformation" in human societies from egalitarian to authoritarian cultural traditions, as early as the Bronze Age. The perspectives of three feminist historian/philosophers all seem very insightful, if perhaps early scholarship on the subject too, Riane Eisler (1987), Patricia Thompson (2002) and Vigdis Songe Moller (2002). Thompson's approach is interesting for a way of tracing the rewriting by Roman historians of the history earlier home centered and democratic traditions of early Greece.

Circulation as the Centre of Natural Homes

The Circulation is an Organism's Commons

4. Flows share the wealth of soil and air.

We tend to think of homes as static places, as the snapshot of information before us at any given moment. Homes are generally built for the growth of the living culture inside them, though, so they are also "events" in time, forever in the middle of changing. The "center" of an organism as a home for its cells is not an open space across which participants share their interests, but a flexible pool of exchange. Plants and animals have no "nucleus" or central commons for holding meetings. What they have is a "circulation" system, a versatile "medium of exchange", that gives every cell a direct role in the life of every other. For a plant the main circulation connects the roots and the leaves, moving resources and wastes, along with passing on environmental signals,

shared with every part. Every cell's outputs are put into the same common exchange pool that also supplies its needs, allowing a plant to develop everywhere at once.

Natural systems that organize around devoted "mediums of exchange" seem particularly prevalent in our world. It's a very easy way to link differently productive specializations of remote working parts. With a steady supply of resources to parts that benefit from their complementing differences, it allows the organism as a whole to benefit, become more adaptive and to smoothly change scale and form, where and whenever those linking differences take place. For a plant you see that in how its circulation connects its very specialized parts for connecting with its main environments, the sun and atmosphere for the leaves, and the soil for the roots. Those two external environments, in turn, become the mediums of exchange between individual plants and others of its own species, for its population ecology, and connecting through those mediums of exchange and others with other species and economies including traditional and technological human ecologies too, of course.

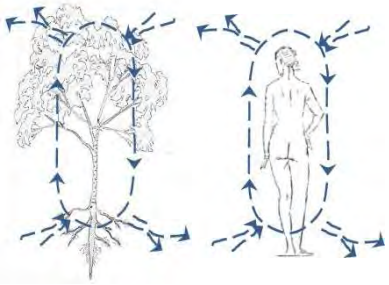
The details of how that works in a fresh water pond are nicely described by S. A. Forbes (1887). It nicely illustrates the ecological principals of complex organization in ecosystem design patterns, and raises a rather provocative question, concerning why these kinds of complexly interlinked populations are so apparently stable. In theory, if individual species tended to dominate then all food chains would be typically unstable, making what is observed in fresh water ponds seem as if the species are all programmed to cooperate . It's very much worth trying to see if you can notice the evidence of what's going on. If you closely watch what animals are doing generally it's *both* foraging and dodging, displaying skillful and adaptive learning behavior. So given that is seems perfectly natural for competing species to be monitoring their common mediums of exchange for signs of *when* for forage and dodge, as well as all the other kinds of signals their lives must depend on (Henshaw 2008). It

suggests that complex ecosystems systems may thrive sustainably even with intense competition, on the condition of using their mediums of exchange for both resources and learning about what to avoid in their environment too. The cases where it doesn't work could be numerous, but would be much less competitive as systems. It would be the ones where it does work which would persist and thrive. One classical recurrent exception, and you might think of others, is the pattern of failure in human economic systems typified by "the tragedy of the commons" (Hardin 1968), in which ample information on dangerous competitive behavior is totally ignored.

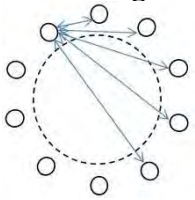
Centers of Autonomy, Two Elemental Types

Circulating Flows & Common Connections

Trees & People



Markets & Meetings



5. Circulation & Commons as Centers

There's also another important reason why this fairly recognizable design that nature uses to accommodate the most complex organizations of life goes unnoticed. and why the natural design of homes for life is not even studied in the sciences. Our usual way of making observations relies on our making up our own organization for what we see. We're not trained to look for nature's. The way to overcome that is to start by looking for patterns, like cells of organization, not just objects. You also look for the flows of change that reflect the presence of hidden systems of change. These and other patterns of natural organization contain a vast amounts of "inside story" that "data" is completely missing, since the organization of "data" is made up by the observer, not nature.

More noted to incorporate….

Medium of exchange as combined ling and short term eco-system memory of what did and did not work
Words "emergence" = 'emerge' + 'ence'. One Look root and suffix search

Note: shifting views

I use shift viewpoints, to expose unexpected issues and open up lots of cool questions. Was reading Franz Nahrada's "Commoning of patterns" article this AM. He used the idea of "the circle" as a model of reaching consensus, but as if an abstraction, though also a bit like Alexander refers to the idea of "center" without saying what it is. It struck me an actual circle has no openings, so not actually a symbol of creativity, as a "meeting of minds" certainly needs.

Note, When circle is not an enclosure

I thought about where, in practice, you find actual "circles", and seem to find them in places also known as "centers". It might be the shape of the table that people gather around, or how people sit around a hearth or campfire or a room. In those cases the circle is not an enclosure, it's an opening in the middle, an empty space across which the communication occurs. Stepping the view out to see a larger scale for why it works you find the circle isn't just a round table "out in the woods", or room in the barn, by itself, but a) where people and resources come traveling from many directions, and b) "a shelter" where they can be undisturbed, with support services.

So, from considering the "working relationships" it may be the ideal concept of "the center" or "the circle" really refers to a "the opening within a shelter", around which diverse travelers can come together to find new ways to fit.

2/28 Notes: Logic works by rules, Nature works by audiences and discoveries.

Hives

--a major source of confusion as we mistake the patterns of information in our minds for the patterns of nature we got the information from, and then rearranged in our own way, not nature's

For example the relationship design of "a meeting circle" within a protected home for the gathering is not really the circular arrangement of the people. It's really the relationships between the people provided by "the round empty space" across which they converse. So it's the particular way they are keep apart that is so successful in cementing the bonds that keep them together, so the whole meeting is an audience for every member. So how we use the recognition of natural patterns of complex working relationships to then further study them, is also used to recognize gaps in what is being studied as we engage with an environment full of natural organization that human culture is to a large degree not inclined to recognize.

patterns we create in our minds, and the patterns of nature our observations are somewhat responsive to, as much as a sketch artist does in making a drawing. The two are in fact always as extraordinarily different in natural form themselves, as the image of a mountain in a camera

is from the mountain photographed in the distance. Mental patterns are located in our minds, made there by our mental processes, and environmental patterns are made by processes of the environment made by environmental processes. Science rests on finding ways of being consistent in projecting (measuring) from one to the other, and back, but a great deal is lost in translation every time.

The biggest reason mental patterns and natural patterns differ in form follows from their construction, that mental patterns are created to be self-consistent (to make just one pattern at a time) and natural patterns are assemblies of an extraordinary diversity of temporarily connected independent parts. They very fundamentally "differ". What's worse is that the problem of understanding how they differ tends to produce a different answer for every person who studies it, creating a truly profound mystery.

III. THE BASIC PATTERNS OF EMERGENCE (from longer work in development)

Life and daily events are full of patterns of emergence, fairly easy to spot, things working together in unexpected ways or new patterns of organization appearing without warning. Records of our ancient cultural understandings of them are recorded in the words of natural language, like:

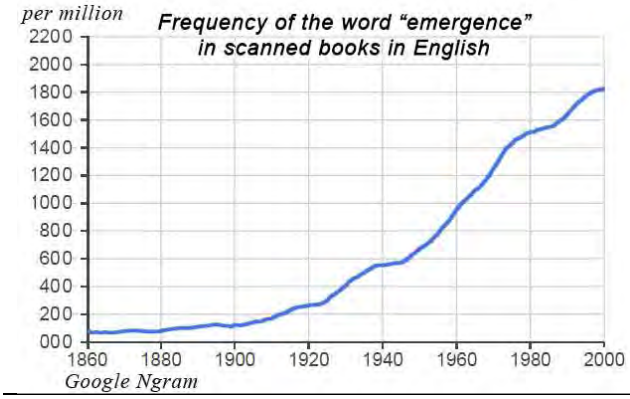
boom	burst	bloom	birth	erupt	create
form	flow	organ	ecology	system	culture
virulence	contagion	organization	integration	confluence	coherence

Table 2. Common words for things with emergent properties

They all refer to common examples of combinations of things exhibiting properties not apparent in the separate parts, that we might easily just refer to as kinds of "organization", as what makes each so different as a whole from its parts. Technological innovation generally

relies on discovering how simple combinations of parts will display altogether new properties, “wheel and axel”, “thread and weaving”, “arrow head and shaft”, “wall and floor”, “food and plate”, “bridge and stream”.

Emergence of “emergence”



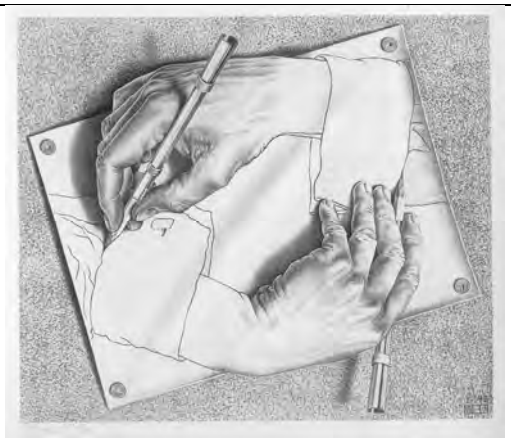
6. The hundred “breakout” fo ‘emergence’

The way they are combined produces shockingly useful new properties. So understanding the patterns of emergence appears to have both to do with how the simple combinations of complementary opposites gives them quite new properties and about how surprised we are and unable to predict what in most cases seem to be such small differences in arrangements having such big changes in what they mean to us. We do seem to spend our lives organizing things to take advantage of their combined properties, and live in a world full of complex organizations that we rely entirely on for the combined properties of their parts, but it’s always such a surprise that we appear to somehow not be thinking about it.

As seen in the Google Ngram here, there’s been a great 100 year swell of interest in discussing “emergence”, as an idea, a property of nature and a property of theoretical models over the last 50 years. With the development of, complex systems science and computer, have f years to test the theories, there has been an intense scientific effort around discovering the “laws of complexity”. It focused on kinds of repeating equations with strange properties like never repeating themselves, generating “bifurcations” in regions of “near chaos” in computer models. What it did do was give physics a new language and philosophy for discussing emergent (Goldstein 2012), on the expectation that advanced theory and modeling would uncover breakthroughs akin to those of quantum mechanics a century ago. Great progress was made

creating emergent phenomena within the calculations of computers. Using the theory to discuss emergence as a natural phenomenon, however, seems to be particularly difficult to define, raising urgent calls for new approaches (Pines 2014).

Theory and Nature Defining Each Other



7. Emerging Patterns, Two Conversations

As the difficulty for complexity science seems to be finding a better way to define the subjects to study, a pattern language approach for singling out recurrent working problem and solution relationships seems perfectly suited. Though the methods of the design and policy communities are quite different, the defining design patterns of emergence would seem likely to be the same whatever tools are brought to bear on them. It's what pattern languages seem good for, defining patterns of organization independent of the methods to be used for using them, one of the important features giving it such success when applied to software development (Tidwell 1999).

The circumstance is a bit unusual, in that complexity science attempts to define physics principles by which language emerges, and a pattern language would be used to help define the subjects of complexity science, a bit as if each of two hands would be drawing the other. Who knows but the combined effect of joining these dissimilar parts, might be transformative for both, and so "emergent", or maybe just incremental. The pattern language for each would not use the abstract definitions for physics, of course, not if it's to be "object oriented" independent of the platform used to apply it. It would be a more universal way of describing recurrent patterns of design for recognizing and solving problems of life in general.

Emergent properties of connection

Theory and Nature Defining Each Other

8. 'Bridge' combined with 'Stream'

The most elemental pattern of emergent design is perhaps the most commonly used and least recognized. It's the combination of things with simple properties giving them complex properties, a "marriage of differentiated parts", both materially as well as perceptually. It creates something altogether new while functionally eliminating the independent properties of the parts.

The deep scientific questions revolve more around puzzles like why does water 'flow' and have so many other complex behaviors, when it's simply $H2 + O^3$. Lacking a real understanding of how the properties arise 'natural constants' are deduced to use in equations, to represent working relationships that are undefinable. There are huge numbers of them, with new ones found frequently. Pattern language works somewhat similarly, identifying some of the emergent properties of recurrent patterns of working relationships.

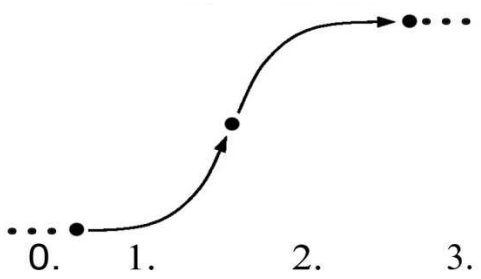
A bridge over a stream creates many emergent properties and possibilities that didn't exist before, while eliminating what the parts combined had been separately. The lid on a jar creates a "container", fingers on keys combine to make "writing", tools with materials combine to create "work". . The range of examples is too great to really categorize, principally it seems because emergent designs "create new categories" as well as new forms of organization, both for nature and perception. As our minds depend heavily on using categories for things, when nature or inventive designs create something new, perception starts from having no categories

[3] eg: Properties of Water: https://en.wikipedia.org/wiki/Properties_of_water and The mysterious nature of water http://www.rsc.org/chemistryworld/Issues/2005/April/Themysteriousnatureofwater.asp

for it. So what a pattern language for emergent properties would be less for cataloging them but to, pick out those which seem most helpful for exploring the worlds of complex relationships that seem to define their own categories. So for example, in business partnerships a key pattern of success is the importance of having a "creative partner" and a "business partner" that see eye-to-eye. Similarly for any kind of multi-disciplinary teamwork having "boundary crossing individuals" to help translate between separately self-defining perspectives seems important. In either case, the importance to the social or business organization is like that for an automobile having a "transmission" allowing it to shift gears, translate the models and join different energies as called for.

The Energy Pattern of Economies

The implied alternating events and stages of emergence as milestones of change.



9. The "Energy Pattern" of Transformation

Recognizing the presence of autonomous systems is difficult because of their internal worlds of relationships tend to be naturally hidden from view. Even if they reveal little external evidence of their internal design and behaviors as discussed in Section II. they still rely on using energy in some proportion to their activity, like anything else. Just as for a studio design project, business development or developing any other kind of organization, as discussed in Section I., it takes energy to build organization. To make a successful chain of events it has to go through stages of development, roughly mimicking the energy use for them, and you can be sure of that not knowing what kind of organization is involved. That those stages of developing organization, generally hidden from view and not really implied by the

pulse of energy use you might notice,, are really the main story of what is happening, is the important part of this "energy pattern".

The main elements are the two periods of transformative growth "individuation" and "maturation", and the three dots, representing events that begin and end those phases of progressive growth, the first the "start-up" process (like any new business needs to get right), its "graduation" moment, (as it switches its motivation from self-expansion to finding and securing roles in its new environment) and finally it's "establishment" in those roles. What you will find surprising is that this generic pattern sequence for transforming complex relationships is so universal, it fits virtually every kind of enduring change. The minimal stages of transformative change, assumed to begin within some finite period (0.) prior to observable change, consist of Initiating events 1, 2 & 3 followed by Developmental Periods of 1, 2, 3. I use two terms for each to indicate the range of things commonly observed to define either the innovation of process of development that follows from it.

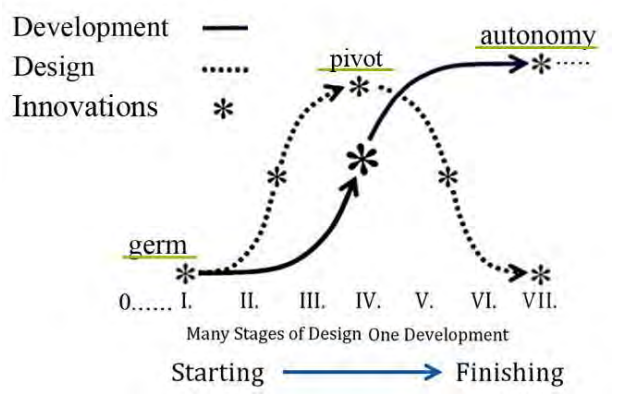
Events of Innovation		**Periods of Development**		**Notes**
		0	Systemic Context (environmental potentials)	Fertile contexts offer resources for which there is no demand and states of calm in which delicate things can develop, or other kinds of open opportunity
1	Inception (Start-up/Seed)	**1**	Emergence (compound growth)	A seed of development needs to use energy to multiply its energy uses (introversion)
2	Individuation (Independence)	**2**	Establishment (maturation)	Separating from the start-up design to find other roles and resources in the world (extroversion)
3	Engaging (Joining)	**3**	**Living** (fulfillment of growth)	Growth and Maturation have built a the natural capital for the roles the emergent system has developed.
Table 3. Table of Milestones for the "Energy Pattern"				

The associated physics theorem implies approximately the same thing, that developmental processes are organizational processes, is itself sort of an emergent property of combining the

three basic conservation laws into one, the laws of conservation for energy, momentum and reaction forces. It's makes a general "law of continuity in change" (Henshaw 2010). By showing that infinite rates of change in energy use are not possible the implication is that that bursts of progressive (escalating) energy use are necessary. It's a separate conclusion that that implies the bursts of progressive organizational development to bring about that accompany the bursts of progressive energy use, given the tremendous supporting evidence of that, and that since nature can't use energy mathematically, leaving no other known way but the kinds of rapidly emerging organizational development often observed to do it. The other parts of this "energy pattern" of natural designs are deduced and confirmed by being very commonly found, reasonable to expect, and so useful to look for as you look for how the hidden parts of the system generating the emergent energy use work and connect with their environment.

How you might apply the energy pattern might range from learning to read the signals of "thriving" and ability to recover from small shocks, when caring for a premature infant, one having had a troubled start, and needing close attention to any sign of failing to develop. Because the pattern is of the *continuity of development* the very same kind of thinking might also apply to a fledgling political campaign, or to a business start-up also struggling to find its footing. You might also use the same sort of attention to details of development for the exact opposite purpose to. You might be trying to stop the development of something, a spreading disease, cult intruding in your community or even a dangerous wandering from what matters in one's personal relationships or social world. Then you also want to be as clear and unassuming in one's observations, to be able to respond to signs that, for example, that suppressing something keeps making it stronger, as a common consequence on not really understanding the system you are working with.

Transformation combining different kinds of phases, innovations and pivot points



10. Design searches for what to add, Development incorporates it.

There are a variety of neutral mathematical properties and patterns of change, in addition to "developmental continuity", that can be observed directly and very helpful to notice for learning what kinds of systems are behind an observed evidence of emerging change. I did an extensive research with good results on how to recognize transformational continuities within noisy data, only to find no one believed it if understanding the algorithms was needed, whatever tests it passed. That said, there are lots of patterns in the progressions of change we can recognize visually when looking at recorded data and thinking about the organization of the systems behind it, world food prices for example, showing periods of progressively rising rather than recovering from natural shocks, that other systemic patterns like that. It's all a matter of building one's intuition for what questions to ask, and if patterns that might be systemic are noticed, being sure ask some probing questions about them. the answers might not present themselves, but that leaves "place holders" in one's thinking for when some other point of view will may come along to show you the answer.

To test one's interest and ability to notice the properties of emerging systems, and create your own approach, you'd pick some transformative change to study that might really capture your interest. You should have enough familiarity with it to be able to ask good questions. It literally could range from something so simple as deciding to study "making breakfast", or something requiring extensive reading, like understanding the origin of the community you ended up becoming part of, or something complexly technical like "sending a man to the moon". They're all great examples of complex emergent designs, relying on long chains of

combining specialized simple parts for their emergent properties, to build complex organizations. What you do first is to verify the procedure you'd use over and over, tracing the steps you can see from beginning to end, to see if that helps you find the hidden steps in-between you didn't know about before.

Where this all came from was my puzzling over why changes in natural shapes generally have distinctly "rounded" corners and intersections, with change over time so widely following "S" curves. It makes "graduated change" the most ubiquitous shape in nature, made more curious for hardly being scientifically discussed or studied. Nature appears to rely heavily on shapes of connection that science doesn't find useful to define. What I stumbled on that let me study then were the micro climates of homes, discussed further in "Air Current and Micro-Climate Formation" in Section VIII. That early study followed from my environmental design thesis on microclimates, in architecture school, and led to my first efforts to define a pattern language for it, as an "Unhidden Pattern of Events" (Henshaw 1979).

As I studied how these shapes developed, seeing how coherent, flowing and systematic the processes generally were, a pattern found in all growth processes regardless of subject area, it became hard to avoid wondering if the rules they followed might be hard to define because these systems were continually changing their own rules as they developed, doing it differently in every individual case, displaying nature being "inventive" not "irregular". I later presented a more formal general systems theory in papers for SGSR (Henshaw 1985a & b) and in the late 1980's began doing studies of the mathematically recognizable features in the shapes of natural of change, some getting published (Henshaw 1995, 1999, 2007, 2010a & b).

Innovate, Multiply, Reorient, Mature, Graduate, Life; Stages of Growth

Fulfilling one challenge leads to the next	
Innovate	• **to get things going** (create the starting pattern)
Multiply	• **to stand on their own** (max immature growth)
Reorient	• **turning to the outside** (sighting a purpose)
Mature	• **refining and diversifying** (preparing for independence)
Graduate	• **ascending to new roles** (join in the worlds of others)
Life	• **the real journey begins**

11. Alternating leaps and struggles

At their start, patterns of developing organization in emerging systems seem to invariably be rather "tentative", "nascent", "immature", "incomplete", "fragile" and perhaps "hesitant", displaying all the signs of immaturity. You can read them as symptoms particular to under-development, of not having fulfilled the potential yet, and not having developed the robust features and resilience a new system will later. The early stages of emergence when new forms of organization are incomplete, as plant seedlings, newborns of any species, capital ventures, new personal life relationships, architectural designs, even political or military campaigns, are always exhibit the patterns of being "immature". It makes their early stages both exciting and risky, and often fail, being relatively defenseless and unaware of their environments, and unprepared for changing directions too. That's a problem for sustainable development, that many communities around the world are already displaying long lasting inabilities to adapt to change, with increasing economic inequities dividing the fast and slow adapters

When working with environmental, social, political or business organization or international problems, these traits help identify separately originating and behaving sub-cultures, marking their boundaries of independently working parts having different experiences. Traits like these, that characterize the whole organization of parts that developed from the same seed of design, like people who speak the same language also sharing in the common culture that developed the language. So the traits associated with each phase of growth from a starting see,

will be expressed throughout the whole system, and so can also be used to help separate what is and is not part of an emerging system.

The idea of "separation" is that the common properties original to one system are separate from those of another. Even if they appear mixed in one's information, original properties of different things aren't. So even the whole house seems disrupted by active children, the immaturity can be localized to them, and not a trait of the household though found literally everywhere. The immaturity of the parents would be unlikely to be of the same kind. Of more importance is that these developmental characteristics that are common to systems that develop from the same origins can help one separate the numerous societal "currents" of , politics, neighborhood culture, business and industry culture, media and even the sciences. The information we get is all mixed up, but the origin of separate societal currents are the innovations from which they developed, that get called "silos" of culture when they develop strong individuality and separation. Whether loosely or rigidly separated, they all develop over time as sub-cultures with a common origin and many common traits. Sometimes it's good to recognize things "in the bud", and make a choice to either feed and care for them or have another response.

Often one has to know a system fairly well to know what its qualitative features mean, like what a person's style of dress has to do with who they are, or like only a gardener would know what changes in the soil they are working in mean.. There's still validity to the idea that if you deeply understand the qualities and complexities of one thing it's far easier to identify those of others. That's much of what pattern language is about, collecting a set of versatile that help you understand a wide variety of situations. Given how varied these complex natural design patterns also makes it clear that one needs to define models and indicators for them in a rather

inclusive ways, to contain the essentials in a way that can be widely reinterpreted, as their meaning varies so much with actual contexts.

The need for traits with more constant definition is what the energy pattern begins with, the three development phases and organizational events that initiate them. You tend to find evidence of those in consistent records of quite unrelated things as evidence of something disturbing its environment. Doctors take your temperature not to measure anything, but to find disturbances to your body's normal energy use to interpret. So called "big data" is probably full of such neutral indicators, that might be helpful to identify systemic change. Changes in word use frequency is something I've found quite powerful, like the use of the word "complex" So the indicators used would best be "constant", looking for light in a dark room you might call it, its in in the , that can be recorded and studied in more consistent ways.

Counting the "graduations" that a growing system goes through, and the degree of struggle and confidence in overcoming them, is one. We all went through a number of graduations ourselves, before we took our independence and used it to invent the roles we'd then work with through our lives. It's really the same phenomena as one sees in the long history of ecological successions, and like a forest goes through, a series of distinct stages of reemergence as it recovers from fire. Even economies have distinct periodic graduations, from working one way and then slowing to reorganize to work another, for that to be carried to a point that some better way starts to emerge, that we call "recessions". As a natural pattern of recurring redesign they might be better called "retooling's". Once you see it that way one can notice how they are generally accompanied by somewhat helpless responses from society and government, as if always being taken entirely by surprise. The fact appears to be that as regularly as they happen, reaching the limit of the current stage of organization of the whole

system, and the need to invent another one, general does take us all by surprise, though it shouldn't somehow.

So in all these ways, the key is more a matter of learning to read the information you have for raising good questions about what the natural and cultural systems related to it are experiencing. It's likely to be misleading to try to give numeric definitions to complex behavior patterns, like redefining words with rich meanings like "thriving" or "balanced" or "wellbeing", and by giving them mathematical definitions reduce them to equations. What proves the better way is to define highly reliable and repeatable measures, easy to collect and won't change meaning over time, and rely on them to raise questions about the changing worlds you are more directly concerned with. We really want to preserve and rely on the robust terms of natural language for referring to true characteristics of the complex systems that exhibit them. A great many observers do seem naturally quite sensitive to recognizing these kinds of qualitative differences, some particularly adept, and if they can share what they notice in a way others can affirm for themselves, then the pattern language method for defining particular objects of design in complex relationships, to work with or toward, can develop.

Finding self-identigy, then new roles

12. Growth turns outward in its steps toward independence and mastery.

The principle design succession of emergent systems, generally following the "S" curve of their energy use, starts with a fragile and immature system growing rapidly. Then in the middle, turning its attention from immature things, to finding its place in the new environment it is approaching. It seems coincidental that the inherent shape of smooth

transformation, the "S" curve, also causes that turning point, from attending to inward to outward relationships, as the first step to independently establishing itself. That principle turning point of emergence seems to inevitably come when its rate of growth is the steepest, but it's more that the rate of growth is always the steepest for exponential curves whenever the developing system turns its orientation to something else. It's not really coincidental, and as for systems that display ladders of redesign over and over, it can happen repeatedly, with long or short periods of maturity in-between. At any time at all along a growth path a system could perhaps pause to secure its gains in development, like family businesses are likely to do, as they choose which hurdles to mount, and which to back away from.

I hope I am successfully using a kind of casual mixed terminology here, as I really don't intend to suggest volition on the part of emerging systems that display behaviors that loosely suggest it. I'm relying on the reader to adjust the right degree of "metaphorical" and "concrete" interpretation to make, to correspond to the actual context and subjects being addressed, If that changes within a sentence or even more, the intent is to be working toward a "pattern language" where the recurrent patterns are available for discussion all kinds of sufficiently identified parallel circumstances.

So far the main theme has been to introduce two readily recognizable great natural patterns that identify the development of autonomous systems in nature. One is spatial, in the forms of the homes that systems make for themselves, and the other developmental, in the successions of redesign they progress through as they emerge and become established. Many of the ways of recognizing them and how they work concern what kind of individual centers of organization they have, either located by 1) their closed boundaries as an indicator of where their hive of complex activity within them is, or by 2) the flowing shape of their

transformational processes, observable in some measure developing energy use, that could be traced back to the center of organization driving it.

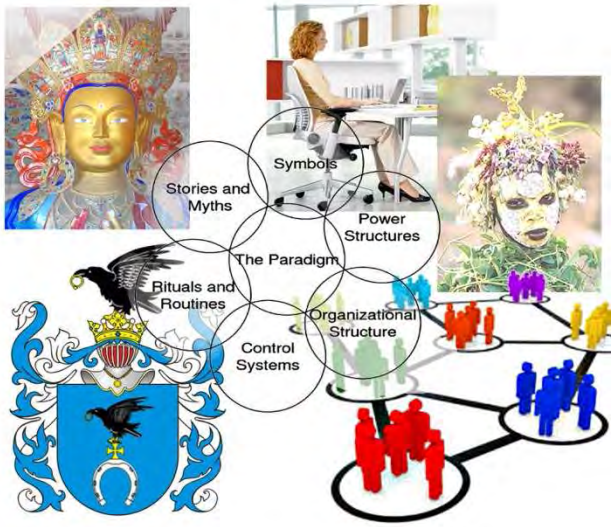
Recognizing one of those patterns in a context can lead to finding many others, as related aspects of the same thing, is the general idea. One may stare from recognizing other features, but as with the "six blind men and the elephant", any part of a system could lead you to many others, if you look for their connections. How to do it is left open due to the unpredictable starting points you might stumble upon, making any system's boundary and developmental patterns maybe the last rather than the first you notice. The boundary and development patterns are just two particularly useful ones, linking a system's "what and how". Once a hint of an enclosure (maybe locating the hidden world of some active system) or shapes of developmental change (maybe produced by a system undergoing transformation), you then have a whole web of other implied features or connections to explore, tying together features of internal organization, its relationships with its environment and how both are or might be changing.

Complex Systems as Individuals, Designed by Developing

Perhaps the deepest mystery of how natural system designs emerge and sustain themselves is in how they 1) develop from a common origin as individual designs , without a model, 2) remain distinct as individuals during their life cycles, and 3) have traits that are present in all their parts. Human cultures and economies, of as well as ecologies and weather systems are often recognizable as distinct individuals that developed without apparent pre-design, to display complex and persistent individuality that persists. It's as if how they first began to develop set a pattern somehow, making those particular circumstances a precedent for all their development in the future, somewhat like a snowflake propagating the geometry of its first crystal. Fortunately, if it's in looking for threads of confirmed evidence, we can follow

patterns without really needing to understand them, just to see where they lead. You might be tempted to hire someone, for example, wondering if they'll "fit in" having had experience with your business culture needing a particular type of person. You might have a discussion in-house to just raise you own awareness, as the solution. Lots of times you don't even need to know quite what you are looking for, as suggested by the idea "just studying a system makes it work better" (para) (Seddon 2008).

Natural systems that develop from a common origin retain their individuality



13. Cultuers are bound by common traits

As to the main question, I don't really mean to suggest that the origin from which individualistic systems develop predetermines their future, as if a "genetic code" for their future. The real appearance of unity of design in individualistic systems does make them almost appear as if created by a single artist's hand and vision. In contrast, of course, is the another persistent trait of individualistic systems, that they develop by innovation, as hosts for new kinds of organization that builds on emergent properties, like economies and ecologies do, and social cultures also do, branching along lines of opportunities as their design process. Maybe the most plausible explanation is that as they develop, building on what developed before, individual innovations don't take hold unless they fit with the whole of what they are building on. We of course see that all the time in economies, new businesses that seem perfectly positioned to develop, but somehow don't fill quite the right niche and just don't take hold. If it matters, a hint of that might prompt a search for the unsatisfied

relationships. That general idea seems consistent with what I know, anyway, of why strongly individualistic systems seem only able to work as a whole.

Granted, we're not culturally accustomed to thinking in such detail about familiar forms of organization developing by viral chains of innovation, their own growth processes, having no prior designs. They're patterns of "viral creativity" when looked at closely, that unpredictably become tremendously exciting sometimes, and other times become an unexpected struggle, hard to tell. All sorts of common life events and changes can be understood much better looked at as building on continual creativity that way, as having emerging structures that form as their branches and interconnections develop. It's also helpful to pause and look back on a history of invention, "taking stock", say looking over the branching decisions made during an office project, or planning a family event, to validate and refresh the values that went it, pick up loose threads or reexamine things.

People also often use both organic design approaches and predetermined designs together. In architectural practice, as discussed in Section I., the design phase is generally divided into distinctly different periods of design that graduate to the next, each by a differently structured organic process, all completed, to produce the pre-determined design for the builder to creatively follow. The architect's and the builder's work each has its own full life cycle of ramping up, doing the work, and then finishing up. During design the capital product of the design, the "deliverable" is being continually accumulated by the design's organic growth process..

That idea of combining organic design processes and pre-determined ones to work together, of course has potential emergent properties, and is very useful to think about in other circumstances as well. One might have what seem like reliable rules to follow for parts of a plan, as an implied "pre-design" them. There would also most likely be places in any plan

where, undetermined organic designs need to be invented, searching for and sifting through differentiated parts to find connections with emergent properties not previously imagined to rely on. To do that successfully people need to be comfortable with shifting from one focus to the other, and be ready to change plans even when hoping to follow set rules. It may sound complicated, but it's also something we all do, though often unconsciously. Depending on one's goals and circumstance it may be more or less important to pay close attention to it. It's a bit like "working with a net", to have set rules to rely on for some parts of an effort, and only invest the effort in real creativity where needed.

Where we see organizational processes occurring in open environments it does seem unlikely that nature is ever "working with a net", of course, following fixed rules sometimes to simplify, rather than rely 100% on local innovation processes to connect all the hidden parts. At some level it'll be beyond our imagination in any case, so people don't need try to understand natural processes entirely, but just look for better ways to work with them. Still, it might be good to try the impossible on occasion, just to push one's own limits and feel how overwhelming it would be. In normal efforts one still hopes not to leave too many hidden worlds of important factors unexamined. So working with natural design patterns should always take a "wide view" of the hidden organic processes involved. We can't know, but it does appear that all the rules we know will inevitably rest on them, as well as the parts with complex and layered designs we can study at scale.

Weather systems, social systems and even economic systems all display the promise and challenge of recognizing the design patterns of organically evolving systems. Human cultures and societies as well (with the economies they contain included), all would appear to have developed from common origins and to retain those common traits as separate individuals. Their development processes, though hard to even outline, seem to display only chains of

distributed accumulative innovation. It makes any rules we might represent them with our own shortcuts, used for describing what we can't understand. The designs of naturally occurring systems determined "opportunistically" rather than "deterministically". In weather events, for example, channels for convection develop where their design at some small scale releases the most energy on a large scale, exhibiting design in the course of development. Lightning forms its conductive channels where the ionization cascades that open them find openings. Ecosystems add to the complex partnerships of interwoven species and niches as new couplings grow more strongly than, all building on long discovered chains of emergent properties.

On small scales the pattern is different of course, but in the formation of our own personal groups of friends, teams in our workplaces or in professional associations, the same kind of distributed accumulation of positive connections is seen, but often only recognized in hindsight. At a mysterious point with such acquaintances, they may seem to suddenly become a "group" or "circle", having its own identity, way of talking, and habits unique to itself. It's unlikely to have developed all at once, at the moment it was noticed is the scientific observation. On thinking about it one is likely to recall very small events occasions that started something going, germinating event(s) of little apparent importance at the time.

Those general features are also all part of the apparent natural design pattern one can use in learning to work naturally occurring systems and how they individually develop. Looking for the expression of the patterns in practice can be a powerful assist for grounding for one's own understanding on nature's designs, but of course, only if you take back from your observations more than confirmation of the assumptions you put into them. That's an essential as well for these natural patterns to become part of "language", such that insights can be shared with others. One also need to be able to confirm and add to one's observations when needed. The

hardest part is likely to be the need of a language for exchanging understandings that the recipients can also confirm, and can also supplement, with added observations of their own to be confirmed too. That is what I perceive happening when to people are “really communicating” anyway, a mutual validation of connecting some insight to the its roots in nature.

Just understanding that autonomously developing systems generally develop as networks of parts and relationships from a common origin, and go through their own stages of immature and then mature development, triggered by innovations in their design pattern , is a great place to start. That those properties also identify such systems as separate individuals with often dynamic behavior and reactions, also means that they continue to remain distinct even while strongly interacting. To validate those views we also need an insight into why the world doesn’t look like I’m describing, really, more like a blur of overlapping systems that couldn’t possibly work as individuals, that is perhaps until you’ve gone to a lot of trouble to identify what parts are all working together. In quantum mechanics there’s a viewpoint that light is *both* a wave and a particle, as a way to deal with contradictions that are hard to explain. Well, for natural patterns, sometimes you can resolve the individuals, and sometimes you can’t. The simple reason seems to be that most of the time we have very “mixed information” making it appear that the world is made of mixed systems. So the next level of insight seems to be that of realizing that having mixed information is like watching static on TV, it really doesn’t tell you much. That of course also doesn’t tell you much, but it can open your eye to looking form confirmable patterns where you wouldn’t have done so before.

-- Chapters 4 to 8 in preparation for longer work Removed –

IV. **CONCLUSIONS** (t.b.d.)

V. ACKNOWLEDGEMENTS (t.b.d.)

VI. REFERENCES (initial list from longer work)

-Alexander, C. (2006). The Nature of Order, Book 2: The Process of Creating Life. Chapter 9.3 "The Whole" p.251-255. Center for Environmental Structure, ISBN-10: 0972652922

Alexander, C. (1964). Notes on the Synthesis of Form. Harvard Univ. Press

-Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I., & Angel, S. A. (1977). *A Pattern Language*. New York: Oxford University Press.

Borchers, J. O. (2001). A Pattern Approach to Interaction Design. *AI & Soc* 15:359-376 Springer-Verlag London

Burkert, W. (1985). *Greek Religion*. Harvard Univ. Press. ISBN 0-674-36281-0

Denef, S. (2012). A Pattern Language of Firefighting Frontline Practice to Inform the Design of Ubiquitous Computing. in *Constructing Ambient Intelligence*, AmI 2011 Workshops, Amsterdam, The Netherlands, November 16-18, 2011. Revised Selected Papers, Wichert, R., Van Laerhoven, K., Gelissen, J. (Eds.)2012, pp 308-312 DOI: 10.1007/978-3-642-31479-7; Excerpt of pattern abstracts for quick introduction, as author recommended: http://synapse9.com/ref/Denef-FireFightingDesignPatterns.pdf

Dinsmoor, W. B. (1975). *The Architecture of Ancient Greece*. W W Norton & Co. Reprint of 1950 3rd ed,, first published 1902. ISBN 0-393-00781-2

Eisler, R. (1987) The Chalice & the Blade. Harper and Row. ISBN 0-06-250287-5

Finidori, H. (2015). An Ecology Of Transformative Action: A Waiting To Be Discovered. *Spanda Journal* V,1/2014, *Innovation & Human Development* , Spanda Publishing, Netherlands

Finidori, Hélène (2014). A Pattern Language for Systemic Transformation (PLAST) - (re)Generative of Commons. PURPLSOC Workshop Nov 14/15, 2014 , prior to the Conference at Danube-Univ July 2015. CC BY-NC-SA

Forbes, S. A. (1887) The Lake as a Microcosm. Bull. of the Scientific Association, Peoria, IL., 1887: 77-87. Peoria, Illinois, pp 77–87. Reprinted in *Illinois Nat. Hist. Survey Bulletin*15(9):537–550. Online in *Early Classics in Biogeography, Distribution, and Diversity Studies: To 1950* (C. Smith Ed.). http://people.wku.edu/charles.smith/biogeog/FORB1887.htm http://people.wku.edu/charles.smith/biogeog/

Gamma, E, Helm, R., Johnson, R., Vlissides, J. (1995). *Design Patterns: Elements of Reusable Object-Oriented Software*. Addison–Wesley

Goldstein, J. (1999) Emergence as a Construct: History and Issues . Emergence: Complexity and Organization, Emergent Publications 1(1) ISSN: 1521-3250 eISSN: 1532-7000. online - https://journal.emergentpublications.com/article/vol1-iss1-1-3-ac/

Hardin, G. (1968) The Tragedy of the Commons *Science* , 13 December 1968: Vol. 162 no. 3859 pp. 1243-1248 DOI: 10.1126/science.162.3859.1243

Henshaw J. (2015). Visualizing Organic Behavior, Change and Transformations. in Finidori, H. (Ed.) *Open Source Pattern Language*, Online http://debategraph.org/Details.aspx?nid=379856

Henshaw J. (2014). Models for Encoding and Translating Design Patterns from Nature. in Finidori, H. (Ed.) *Open Source Pattern Language*, online http://debategraph.org/Details.aspx?nid=365553

Henshaw P., King, C., Zarnikau, J. (2011). System Energy Assessment (SEA), Defining a Standard Measure of EROI for Energy Businesses as Whole Systems. *Sustainability* 2011, 3(10), 1908-1943; doi:10.3390/su3101908, online http://www.mdpi.com/2071-1050/3/10/1908

-Henshaw P. (2010b). The Energy Physics of Continuity in Change.; draft pending resubmission, online: http://www.synapse9.com/pub/drtheo2010.pdf

Henshaw P. (2010a). Models Learning Change. Cosmos & History, vol. 6, no. 1, ISSN 1832-9101, online http://www.cosmosandhistory.org/index.php/journal/article/view/176/295

Henshaw, P. (2008). Life's Hidden Resources for Learning. *Cosmos & History*, vol. 4, nos. 1-2. online http://www.cosmosandhistory.org/index.php/journal/article/view/102/203

Henshaw, J. (2007a). 4Dsustainability - A Whole System Learning Process & Design Method. Model Wiki for collaborative teams, online http://synapse9.com/connection

-Henshaw, P. (1999). Features of derivative continuity in shape, *International Journal of Pattern Recognition and Artificial Intelligence* (IJPRAI link to article), for a special issue on invariants in pattern recognition, V13 No 8 1999 1181-1199

Henshaw, P. (1995-9) The Physics of Happening. collected case studies and analytical pattern recogniaion methods. Online: http://www.synapse9.com/drwork.htm & drstats.htm

-Henshaw, P. (1979). An unhidden Pattern of Events. republished 2014 in *An Open Source Pattern Language,* "Patterns of Complex Natural Systems" by H. Finidori. Originally in book of same name, self-published edition, Denver 1979. online http://debategraph.org/Details.aspx?nid=360233

Henshaw, P. (1978b). Natural Orders in Convection. Report Supported by Int'l Soc. for Solar Energy Research. online: http://www.synapse9.com/pub/1978%20NatOrdersConv-Henshaw.pdf, "Air Work" notes online http://www.synapse9.com/airwork_.htm

Henshaw, P. (1979). Sneaky Invisible Things, Air Currents of Classic Passive Solar Homes, Rain Magazine, Tom Bender Ed. V5 No6 Apr 1979 Portland, OR. scan online http://www.synapse9.com/pub/1979RainSneakyInvisThings.pdf, text online http://www.synapse9.com/airnets.htm

Jacobs, J., (2000) *The Nature of Economies. Vintage Books*, New York

Jacobs, J., (1994) *Systems of Survival: A Dialogue on the Moral Foundations of Commerce and Politics*. Vintage Books, New York

Jacobs, J., (1984) *Cities and the Wealth of Nations*: Principles of Economic Life. Vintage Books, New York

Jacobs, J., (1970) *The Economy of Cities*. Vintage Books, New York

Kuhn, T.S. (1962). *The Structure of Scientific Revolutions*. Univ. of Chicago Press. SBN 226-45804-0

Lawrence, A. W. (1996). *Greek Architecture*. Pelican History of Art

Lietner, H. (2014). Pattern Language and Christopher Alexander, intro & crash course. Guest lecture at Danube University Krems, Jul 31, 2014. online video https://www.youtube.com/watch?v=Q4R7dDtLYgU

Nahrada, F. (2013). The commoning of patterns and the patterns of commoning", in *The Wealth of the Commons*, David Boiler & Silke Helfrich ed., the Commons strategy group

Pines, D. (2014) Emergence: A unifying theme for 21st century science. *SFI@30: Foundations & Frontiers.* Santa Fe Institute Bulletin, Fall 2014, Vol. 28, Issue 2. online, https://medium.com/@sfiscience/emergence-a-unifying-theme-for-21st-century-science-4324ac0f951e

Rosen, R. (1991). *Essays on Life Itself*. Columbia Univ Press. ISBN 0-231-07565-0

Rosen, R. (1996). Boundaries and barriers: on the limits to scientific knowledge in *On the Limitations of Scientific Knowledge,* JL Casti, A Karlqvist (Eds.) 1996. Basic Books, P208-9

Schuler, D. (2014). Pattern Languages for Public Problem-Solving, Cultivating New Seeds for Social Change. *PURPLSOC Workshop*, Krems, Austria, Nov 2014

Schuler, D. (2008). Liberating Voices: A Pattern Language for Communication Revolution. MIT Press, Cambridge, MA.

Schuler, D. (2002). *A Pattern Language for Living Communication, A Global Participatory Project*. Proceedings of the Participatory Design Conference, T.Binder, J.Gregory, I.Wagner (Eds.), Malmo, Sweden, 23-25 June 2002, ISBN 0-9667818-2-1.

Seddon, J. (2008). *Systems Thinking in the Public Sector*. Triarchy Press, UK, ISBN: 978-0-9550781-8-4

Songe-Moller, V. (2002) Philosophy Without Women, translated by Peter Cripps. Continuum press, London. ISBN 0-8264-5849-1

Thompson, P, J. (2002). *The Accidental Theorist: The Double Helix of Everyday Life*. Oxford: Lang. ISBN 0-8204-5782-5

Tidwell, J. (1999). A Pattern Language for Human-Computer Interface Design**.** (c) 1999 Jenifer Tidwell. online http://www.mit.edu/~jtidwell/common_ground.html, resources http://designinginterfaces.com

Turing, A. M. (1952). The Chemical Basis Of Morphogenesis. *Philosophical Transactions of the Royal Society of London*. Series B, Biological Sciences, Vol. 237, No. 641. (Aug. 14, 1952), pp. 37-72.