

Guiding Patterns of Naturally Occurring Design: *Mining Living-Quality*

Jessie Henshaw, HDS Natural Systems Design Science, New York
eco@synapse9.com

Abstract:

The “*living-quality*” provided by well-made things comes from both the fully satisfying services for both users and providers, and the way that satisfactions spreads delight and a feeling of wholeness in the world around them. They display “simplifying ideals” and “unifying responses” to the “forces” found in their “recurring contexts” producing “emergent properties” not achievable other ways, are the essential parts of their “*pattern-language*.” That link such designs create bringing satisfaction to the worlds of both their users and providers widely spreads its *living-quality*. A design-pattern for drawing out that *living-quality* of good design that is the focus here, starting from considering designs as bridges for exchanging services between the worlds of serving and served communities. Ways of finding guiding examples of the naturally occurring designs that contribute *living-quality* as a satisfying fitness for their worlds are a source of lessons to be learned. The formal design-pattern discussed is called: “Mining Connections for *Living-quality*,” demonstrated using examples from *pattern-language* papers from the 2014 PLoP meetings to illustrate. That is followed by sections on general theory, methodology, and the use of large repositories of natural patterns from which to learn. This discussion of applications follows from the general elements presented to PURPLSOC 2015 (Henshaw 2015) of recognizing and studying guiding patterns of naturally occurring design in general.

Keywords:

Natural systems, design patterns, pattern language, pattern search, pattern repositories, growth, transformation, living quality, dual paradigm, object-oriented science

1 -Introduction

A *pattern-language* approach to discussing complex designs does not use technical language as much as careful use of natural language. So the meanings and usage do not rely so much on special definitions as much as those that accumulated naturally from human life experience over time. So to the meanings discussed here more rely on common natural language source experiences from which our familiar words come. That would involve recalling our reactions to the naturally occurring designs, and conditions thought important enough to give names to and build a language around. Using language to think about the experiences the words we use come from is using language somewhat backward, so takes some practice. It is also a highly informative and useful way to discover the designs of nature that seem important to us and how they arise from and resolve the forces of our world. It is also a way of “grounding” natural language, so it more directly connects with common experiences we share with others, as well as then more useful for working with nature’s designs too.

Familiar contexts and experiences our words seem to refer to as the source of their meaning are found by using a word like “box” to refer to what we have experienced with boxes, and the word “trouble” to refer to strains on complex relationships we have experienced. To expand the richness of those “search words,” we then think through all the varied experiences we’ve had with the circumstances for which the words are used. You tend to find is that the root meaning of a word comes directly from the particularity of the natural circumstances to which it is a response, defined by the design-pattern of nature not by other words. That way of recognizing the *design-patterns* of nature uses natural language as a great repository of naturally meaningful designs, and

associates that root *design-pattern* meaning with all the related uses of that word, and so to find other examples of the naturally occurring design to learn from. Perhaps the approach sounds abstract and complex, but starting with deep ideas is a good starting place too, so you get the full value of them when they come to feel natural.

When reading long papers, especially on unfamiliar subjects, it is good to pause and think over the sentences just read, and extend one's own thinking. New subjects demand so much concentration one needs to pause at times, to develop one's thinking and absorb what you want. If some kind of natural process of "exchange" or a kind of "resilience" is discussed, for example, one can create memorable detail just by recalling when and where you've had related experiences. It is of particular help if you can recall, or makeup, little stories or sketches to illustrate a "rule," or the "exceptions," or try fanciful ways of over or underplaying either, testing out the ranges of their meaning.

Doing that at breaks in reading helps show the true hidden 'forces' one has to contend with, watching to see if they move, exposing their usually undisturbed 'roles' to scrutiny. Those ultimately define the 'circumstance' confronted. That exploratory reading process would be about the same for either considering intentional designs or naturally occurring ones. You start someplace and search through the relationships one would need to understand to respond to them. Sometimes the natural limits of that search are just the limits of one's imagination. Sometimes they are sharply defined by discovering the natural boundary of the system you find one's self studying, the bounds of the 'niche' or 'home' or 'culture,' where the center of dense organization defining its place and being are located.

Freely thinking over what you're reading with informal heuristics like these is important as a way to experience them, keep you sharp and open-minded too. Hidden patterns are exposed when you try new stories for familiar circumstances, like imagining how a "handshake" or "greeting" easily affirm the trusts needed for business agreements sometimes, but that a small hesitation or haste might convey a quite different meaning. What if you went to a boathouse to rent a canoe for the afternoon, and you were given badly damaged paddles, the operator cheerfully assuring you "oh yes, we only rent broken paddles" as if expecting one's thanks. You'd feel lost and confused, forced to question everything about the day, perhaps, with something so "out of place." It helps you see the very

complex design a normal business greeting is a part of. It also exposes how the living qualities of ordinary transactions are so very important; functionally as well as nice. You might be more conscious of providing for them all in some circumstances and see how to be more casual in skipping some in others. It is testing them for fun that lets you see how they work.

The origin of this approach to *pattern-language* was the author's years of research on recognizing patterns of design in eventful natural energy systems (Henshaw 1979, 1995-9), detailed study of micro-climates and forming a general theory of the pattern in their designs. That work had the wonderful result of leading to a general method for studying individual systems of all kinds; their the design and behavior. It also turned out now to be a way of recognizing natural designs that fit very well with the practice of *pattern-language*, understood as:

“A practice of finding and using simplifying ideals of holistic design for fully responding to recurring *patterns of forces* in a *context*, having *emergent qualities* and *natural fitness*. using a common way of being explicit in using natural language for “describing the invariant qualities of all those solutions.”¹

That compatibility allowed my earlier work to be translated into a *pattern-language* vernacular here, for record and to reach a wider audience, as well as to add new uses and generality to the practices of *pattern-language*. This paper is the second of two, the first “Guiding patterns of naturally occurring design: Elements” for PURPLSOC this year (Henshaw 2015). Below is a key to the use of quotes and italics for emphasis and definitions of key terms. 2

¹ phrase “describing the invariant qualities of all those solutions” from Tidwell 1999

² *italics* - used for a) technical *pattern-language* terms b) general text emphasis

quotes - used for a) actual quotations, b) emphasizing a use in context, c) to emphasize to a word's natural subject d) to refer to a recurrent natural pattern

pattern - individual and recurrent organizations of naturally working relationships, as well as descriptions referring to them, normally material forms but perhaps holistic conceptual forms

pattern-language - The practice of explicitly describing such holistic designs originated by Christopher alexander, the clusters of connected pattern descriptions composing a larger scale pattern of design, and the integrated whole forms of natural organization that are the subjects

living-quality - life giving relationships, services, perceptions and inspirations produced by whole patterns of design

Stopping to think of stories will also help with recapping the frequent vignettes or getting the idea for the occasional deep dives into advanced topics. The approach was also a somewhat pedagogical choice, for introducing a broad field not with a survey, but more with core subjects. The main interest is to provide a good sampling of the approach to give readers places to start their thinking. So each topic presents various parts of interesting problems and some of the kinds of solutions explored, a good way to give both advanced and beginning readers interesting overall impression and useful points of entry.

The paper begins with introducing a pattern: “Mining Connections for *Living-quality*” (Table 1. & 1a.). It is a method for examining a design’s connections with the living world to both validate and add richness to its design for services affecting its connections and environment. So it is a very general pattern for learning from a working *pattern’s* interface with its world. It would be good to use at each stage of its design and implementation, as well as later for conditions changing. Then two sample applications are discussed, for mining added *living-quality* for the patterns presented in two research papers from PLoP 2014. Then similar length sections on “Background and Theory” and “Great Natural Pattern Repositories“ follow.

It is unusual in a research paper to present the user practice first, with the theory and resources for it to follow. It is done here to introduce the parts likely to be most familiar to readers first, to help with seeing what the new method is for before presenting details. It also responds to the general finding that “practice and theory are much more intertwined than we often realize” (Kohls 2014) Hopefully, it will make the theory more understandable, as it is only in thinking about the practice and its opportunities and challenges for which having a theory helps. So as you read the application, one might think of various other uses and the questions they would raise and need special resources or methods to help resolve.

Imagining related stories and thinking of applications while reading makes you read more slowly and go back to reread things too. It also builds a more “bushy” tree of ideas to mull over and to be starting points to going further. Thoughtful readings of long papers cannot be done in one sitting but lets one read for content for as long as desired and pick it up again at another time. Retaining one’s questions on the subject will also help with other reading.

2 Mining Connections for Living-quality

That idea of how a *design-pattern* as embedded to serve to its living world is the subject of Fig 1. Enhancing a pattern's services to living things is one of the main ways of mining *living-quality*; making better connections. Any design receives services one place and delivers them in others while also being responsive to its environment. The real aim is not only to be more responsive and provide better services; it is also to aim at fulfilling the "whole need."

Designs embedded in a living world

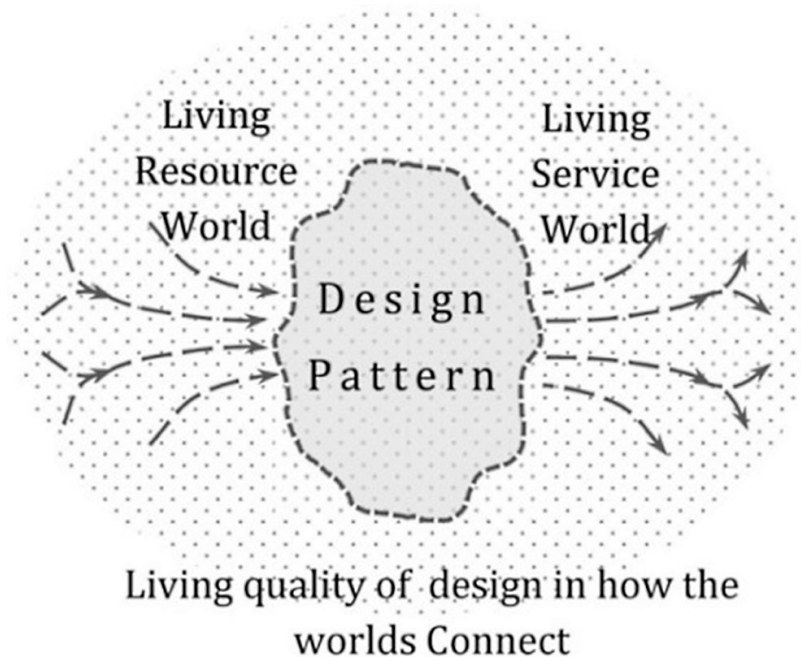


Fig 1.

Flowing connection

If I think of the "whole need," such as for a traveler on a wet night entering a restaurant, thinking about their desire to get comfortable, I might think through the various discomforts and what would relieve them. Is there a place to put wet clothes or is there space for a few people to chat. Every "connection" needs to be

a way to join one structure or process with then next, a gap for fitting parts to coordinate, both firm and flexible. Then a “joint” or “handshake” between different structures lets them flexibly work together. All designs have those zones of complex connection wherever working parts are joined. The details of well-made connections and important secondary needs too are often not discovered unless actively searched for, by asking both about what is needed and what is missing.

- *Reader hints... You might think of a few designs you often use and identify how its service enhances one's world and how it comes from the world of the service provider it connects one's world with. You can then loosely or closely examine how well the designs do that by thinking up stories of “what might go wrong” or “what would be wonderful” as the premise. The living-quality provided is often in how easily users and providers can “feel at home” with the design, in all the meanings of that, as “a welcoming design” in both the practical and experiential senses.*

So the idea in asking if any connection serves the “whole need” is to “look around” and think about the complexity of the need, and from the view of the living systems being served. It makes a designer's job a complex task of imagining and being responsive to serving other's needs and roles. Thinking about such details, one can also trace pathways and look for “bottlenecks,” or “short changes” that detract from a design's ability as a whole to be a real center of *living-quality* in serving its purpose.

To do that a designer needs rich experience in noticing the complexity of needs their designs serve, a habit of “looking under the rocks” to see how naturally occurring designs interweave complex networks of services for living things to thrive. Finding a pattern in either served or serving relationships not thriving can be a sign of something altogether missing from the design, or missing at the time when it is needed. Both of those kinds of observations require developing a practice of noticing the patterns of natural designs. There will always be unexpected user groups, for example, and finding how to fully respond to their difficulties a fine art that usually pays off in smoothing the flow of every other group too. It helps to stretch one's imagination and think of examples.

The general technique discussed most in this paper is searching one's own experience to learn from it in a new way, a technique I call *pattern-search*. To learn more about a particular service to be provided it helps to find diverse examples to learn from. The *pattern-search* technique is first to form a more generalized idea of the subject to use for searching widely for other varied examples.

For example, say the service to be provided is something specific, like "docking." You might then look for examples of a more general kind, say using the idea of "meeting," perhaps. The more general pattern helps you find diverse ways of delivering the same generic service, in that "docking" needs to include "meeting," but not the reverse. For mining *living-quality*, the big advantage is that this kind of *pattern-search* brings up lots of living examples of how "meetings" of all kinds are arranged, those in which the *living-quality* is both well and poorly served, in natural circumstances, and see meaningful examples of nature's elegantly complex and satisfying ways.

That can dramatically open one's mind to what the whole service is, in this case, to first provide "a good meeting" for the critical functions of the "docking." Using *pattern-search* to survey recurrent general patterns of design found in living environments also gives you a very rich contextual exposure and understanding of them. The key is finding a sufficiently general pattern to let you discover a wide variety of living examples that are also relevant, to learn about an individual thing by looking at a large family of them. With practice, searching one's experience for varied examples becomes fairly easy, while exposing related families of designs letting you expand one's search further if needed.

Persistent natural designs generally originate with some starting pattern of design that replicates, as one sees either a snowflake or a business developing from (Henshaw 2015 Sec 4.1). We're very familiar with why a business cannot start without a start-up plan. The same pattern of "accumulative design" is seen in how relationships of all kinds cannot begin without steps of emergence or introduction, or how technologies cannot develop without their initial ingenious small innovations. Every beginning needs a starting pattern. That is a general pattern of natural design that pervades intentional designs too. They cannot develop without having a way to start. Generally, a start-up pattern comes about

by a smaller-scale process that builds up at first by replication, taking its natural course, and facing a challenge at its limit.

For mining *living-quality*, we only need these basic ways of recognizing patterns of naturally occurring design, bringing to mind what we already know, such as tacit understandings of language, our own cultures, and experience. Another familiar natural pattern we know a lot about is how “start-up’s” and new living things are rather “immature” at their inception, and then go through various stages of maturing as they develop. It is a quality that few things can hide, and a deep indicator of the qualities and resilience of the design in the process of maturing.

- *Reader hints... For a community of local businesses that develop in a certain section of a town, the start-up is often some notable “pioneer,” who “breaks ground” creating the model on which others develop variations. You may have examples in one’s town, of a cluster of businesses, like a large and small industry or an ethnic grouping collects. Try to recall or imagine the starting pattern as a combination of services that found its new home and then spread that way, to define its boundaries and culture.*

The pattern writing template for mining *living-quality*, Table 1, was adapted from a more standard form of pattern template (Table 2.) and an extended form (Table 3.) developed for describing the more complex *design-patterns* of naturally occurring designs. Those are from Slide 8³ of the companion paper (Henshaw 2015) and discussed in Section 3.5. The main difference between describing intentional designs and naturally occurring ones is, of course, the presence or absence of a designer, so that for naturally occurring designs you are forced to consider the design as evolving by itself, and not following externally imposed purposes.

Another similarly noticeable quality of natural designs is their frequent distinctive individuality. Natural individuality is remarkable in seeming to both develop over time toward some ideal or state of perfection, and to also seem to persist from its origins, unfolding during development. We easily recognize individuality in the character of people, as something they are born with and is

³ http://synapse9.com/_PLref/2015_PURPLSOC-Slides/2015_PURPLSOC-jlh-Slide-08.jpg

fulfilled as they grow. Similarly, even social, artistic and professional movements, all tending to retain strong connections with their originating “seed patterns” as they grow and mature. We also see it in emerging technologies, where more complete ways of responding to a useful concept are what innovations tend to lead to, replicating the seed patterns with every addition. Individuality is also elusive, built into the things of nature but often not accessible to our minds.

Table 1. Mining Connections for Living-quality

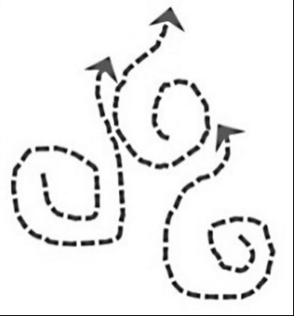
<p>Name: Mining <i>Living-quality</i></p>	<p>Domain: Joining intentional and natural <i>design-patterns</i></p>
<p>Image:</p>  <p><i>Living-quality</i></p>	<p>Context:</p> <ul style="list-style-type: none"> • Refining a proposed or working <i>pattern</i> <p>Forces:</p> <ul style="list-style-type: none"> • Designing to fully serve both a design objective and the needs of service user and provider cultures being connected • A chance to study secondary effects after resolving primary ones • The ideals of qualitative design to bring <i>living-quality</i> to serve the world being worked in • The hidden conflicts and unserved communities not noticed <p>Resources:</p> <ul style="list-style-type: none"> • The <i>design-pattern</i> and its world of connections, • A designer’s connections and life awareness • Natural <i>pattern</i> repositories to explore for creative ways of offering living qualities
<p>Concept:</p> <ul style="list-style-type: none"> • Designs are a bridge between living things serve and served by, thriving in the <i>living-quality</i> found. 	<p>Solution:</p> <ul style="list-style-type: none"> • To provide whole services and validate them, we study a design’s service user and provider connections, looking for unserved secondary qualities and needs. • Searching related natural <i>pattern</i> repositories provides living examples to study for features on which living environments thrive.

Table 1a. Supplemental values

<p><u>Theory:</u></p> <ul style="list-style-type: none"> • Expanding the possibilities in the near environment adds to its fertility and resilience, serving the whole. 	<p><u>Stages:</u></p> <ul style="list-style-type: none"> • We review the design and the places its connections can be explored and types of searches and methods to use. • Then trying a variety of approaches to discover where to dig into details, use teamwork, and build rich views. <p><u>Other useful results:</u></p> <ul style="list-style-type: none"> • A good way to validate designs before passing them on. • Exposes nice finishing touches while still in design, on the whole, adding to the whole's flow and resilience
--	---

We may not recognize the character of friends and associates till they “blossom,” for example, when who they have always been suddenly begins to show. That is one of the great reasons naturally occurring designs can very much surprise us; their uniqueness may be hidden from our view till it fully develops. A simple example would be to compare the habits of a struggling young waiter and a sophisticated older one. They may have started their learning the same way but are at different stages of becoming masters of the craft.

Table 2. Template for Describing Intentional *Design-patterns*


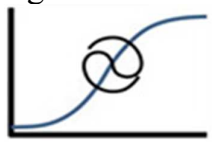
Name	Context	Forces
<p>Image</p> 	Problem	
	Solution	
Subject	Actions	Results

Table 3. Template for Describing Natural *Design-Patterns*

Name & Type	Problem Boundaries & Scales Life Cycle	Forces Resilience Animation
Image 	Context – Arrangements of: <ul style="list-style-type: none"> • Centers • Roles • Stages • Movements 	
Simplifying Relationships	Object Domain & engagement	Solution Learning process
Links	Results, Tracking & Anticipations Open questions	

We can see there may be unbalanced *forces* to contend with if they have to work together and also can see a chance of creative energy drawing on sophistication and experience, the sharing of artful practices the opportunity. If one's software has a mix of resources of unmatched quality like that it might help you think about how to make better use them. If you're the designer for the restaurant, you might need to create reminders and help the owner learn a regular practice of culturing a style that all the waiters intentionally share.

3 Examples from PLoP⁴ 2014 papers

To briefly illustrate ways to apply the *design-pattern* for mining *living-quality* in Table 1, I looked at how it might be done for two studies discussed at the PLoP 2014 meeting. They illustrate important things about *pattern-language* as well as about mining *living-quality*, by exploring how they serve their user and provider relationships. One is a way to suggest evocative illustrations for a pattern, that might be enriched by exploring the values to those serving and using the *design-pattern* illustrated. The other is a way of examining the *design-patterns* of software scheduling routines to compare them with naturally occurring equivalents and suggest better ways of understanding what “scheduling” means.

This approach also illustrates how discovering new perspectives of a whole can add dimensions to it. It is the same for a business as it is for a person that every working system has diverse hidden potentials that only need to be recognized. When they are recognized, it adds new dimensions to both how the whole is thought of and what it can do, an interesting place where perception and nature overlap. Some of that benefit can even emerge from how difficult it can be to understand the intent of patterns others describe when only thinking of readers already familiar with the subject. One then needs to use imagination in enriching the description of circumstances and using suggestive names and illustration to convey the pattern discussed.

Of course, that could be thought of as the perennial problem everyone has when trying to read almost any research paper, as the reader is often not familiar with the specialized subject. For *pattern-language* papers particularly one might generally expect a more diverse readership, due to discussing general patterns that may recur in varied situations. Then the use of special jargon, technical terms, and references to traditional debates would generally be a barrier.

It is not easy to avoid, of course, when disciplines come to rely on their technical language. One interesting one came up in the writer’s workshop for this paper that some of the standards of quality for software design have been using names that do not correspond to the English language meanings for the same terms. One case was the use of “coherence” (as a technical term) to mean

⁴ 2014 Pattern Language of Programming meeting papers (Hillside Group, 1993-2015)

“appropriateness” (the meaning intended) even though those conflict. In describing *design-patterns* a confusion of terms like that could be highly consequential. So any paper on the subject needs terms with natural meanings and discussions that any informed lay reader can understand. *Pattern-language* is intended to be a common resource and language for any design tradition, not vehicle for creating specialties no one else can understand. As done here, it can help to show technical terms in quotes or italics, to distinguish them.

3.1 Pattern Illustrating

3.1.1 Center-words and Working-words

Harasawa et al. (2014) offer a method of developing pattern illustrations, taking suggestion from evocative words they termed *center-words*, terms found in the pattern descriptions they had developed in workshops. (Harasawa et al. 2014) defining them as:

“The words within the pattern which hold strong meanings that you think are critical to represent the essence of the pattern words are extracted out to form the image of the living structure of the pattern in our heads.”

I’m showing the term *center-words* in italics here, to highlight its technical meaning. It is a common practice in writing about patterns to give them evocative names that are easy to remember and suggest or characterize the role or working features of the design. That common practice then seems to also fairly closely fit the definition for ‘*center words*’ offered by Harasawa et al.

That fashion of natural language use, picking illustrative names for things, as a “signature” or “brand” for them, can be seen as a very common and useful practice, connecting nameable things with words that bring up for associated feelings, like naming cars for animals. When choosing stylized names for patterns or looking for words to suggest for illustrations for them, one would ideally want them to suggest the feelings associated with the organizing principle and form of center the pattern creates, giving it its meaning as a whole. Such suggestive words express our emotional response to the emergent properties of designs, the change they make as a whole.

Words that instead are more effective in describing how a *design-pattern* works (rather than why it matters) turn out not to make good names, feeling fairly lifeless and unimportant. That was discovered by testing the use of terms that only describe the instrumental features of *patterns*, as opposed to what they come to mean when assembled and working, termed “*working-words*” here. The following are simple examples to illustrate. Try distinguishing “how things work” from “what they mean to us.” The difference arises from the pattern’s “emergent properties,” that are inexplicable from how it works but are the main reason the sum of the parts is meaningful to us.

Table 4. <i>Working-words</i> (how it works)	Center Words (why it matters)
verified exchange of ideas	communication
central table	conference
complementary fit	marriage
open road	journey

To very briefly summarize the findings of Harasawa et. al., the group first collected and categorized types of *center-words* from the whole collection of 108 *design-patterns* developed in their lab, finding some 500 different ones, which they categorized in 13 groups, 6 categories of Composition words and 7 of Element words (Table 2. & 3.).

Table 5. Composition Words	
Forms of Power	Arrangements
Directions of Power	Forms of Status
Movements of Power	Periods of Time

Table 6. Element Words	
What	Feelings
Properties of What	Temperature
Actions	Atmosphere
Properties of Actions	Properties evoking them

To develop illustrations for each pattern, they collected and organized the *center-words* found in its descriptions. They then looked for those words to express a living structure or suggest a vision, to prompt the illustration.

Fig 3. Chosen illustration “Language Shower.”

The example presented was for illustrating a pattern for language learning using immersion in the language being learned, they named “Language Shower”. The steps of the process used two stages of collecting evocative words and then composing them (Fig 2) and synthesize the full illustration (Fig 3), called “language shower.” The basic steps taken would be about the same for mining images with living qualities from naturally occurring designs, with added focus in searching though the living connections of the pattern with its environment.

3.1.2 Discussion of Pattern Illustration

The “Language Shower” illustration is itself quite evocative, but it could also start an exploration of how it serves the writers and users of the language immersion *design-pattern*, and perhaps enhance the *living-quality* each enjoys from it. Here the team used *center-words* from their own collected notes and texts for describing the *pattern*. We might ask; Are there other sources for suggesting the meaning of the *pattern* to the users and creators of it? One of the better options is immediately suggested by then asking; What will the *pattern* mean to its users and might convey to them what success with it is for? In this case, the pattern first gives language learners an added struggle with the language and then the delight and pleasure fluency, that both come with learning by immersion. That is a classic before & after image that might provoke lots of interesting illustrations.

Other possibilities for adding *living-quality* can be found by comparing the team’s pattern with the fairly similar method I happened to use for illustrating the paper’s pattern “Mining *Living-quality*” (Table 1), with the symbol of “liveliness” shown in Fig 4. In developing the symbol I did not explicitly extract evocative *center-words* from the completed text of Table 1. My approach was more the reverse. Halfway through describing the *pattern*, I searched for a symbol to evoke its intent and first arrived at Fig 1. It more illustrates how the *design-pattern* works than what it means, though.

To find an image suggestive of what it means I first did an online image search, using all the descriptive terms I could think of, without finding anything. Then I started drawing diagrams of how the *design-pattern* connects its serving and served connections that became Fig 1. That was very good, but it had little feeling

of *living-quality*. It was too much like a working diagram, illustrating the *working-words* of importance for making the pattern work, but not suggestive of what the pattern was for. As I thought about how It worked I began thinking more clearly about why it mattered, thinking of situations closer and closer to what happens at the interfaces between designs and the things they serve and are served by. That brought up images of what it feels like to have an experience that wakes you up and lets you thrive, and things like that.

Life emerging

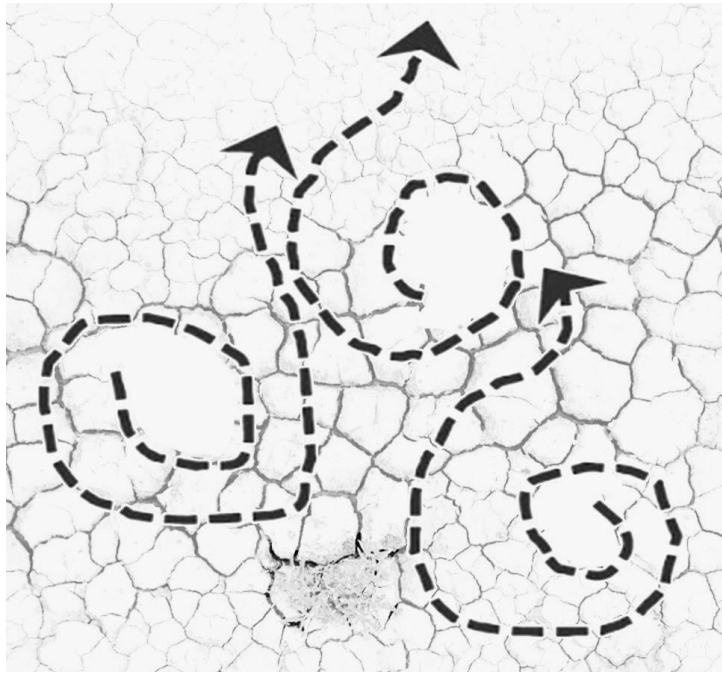


Fig 4. Liveliness

Providing and using patterns of design and services that contribute to *living-quality* in the form of thriving environments is certainly one of the ideals of using *pattern-language*, seeming to be what Alexander I think means by ‘*fitness*’. It is what happens at those nodes of complex “semi-lattice” intersections, the “street corners” that attract thriving people, serving as centers of spontaneous connection (Alexander 1965). That is what my efforts to that point were not capturing somehow. I recalled a doodle from a few weeks before and worked with variations on it till I almost gave up with that too. But then I noticed a group of discarded versions of the sketch at the side of my drawing screen, arranged by accident where I had pushed aside my unused attempts. It was quite close to the version

seen in Table 1 and Fig 4. It might not be the final one, but captures part of the idea, representing *living-quality* as the liveliness of “little motions coming to life.”

That happy accident also brought out the similarity of my process with that of Harasawa et. al., and the aim of finding the picture that works. Most of the differences in approach may come from my tendency to use wider patterns of search, aimed at pushing outward for suggestions. That is, of course, part of where the pattern for “mining *living-quality*” came from. Here I was also reminded by that pattern to look for how well the living connections were being served, and by the difference, I found between *center-words* and *working-words* indicating that signature names and images need to convey what the pattern is for more than how it works.

One other general observation, applying to any search, is that testing multiple objectives and ways of searching may be valuable. Until you find what you want, and that at first, you might not know what you are looking for. The use of *pattern-search* does that directly. For writing the pattern for “Mining Connections for *Living-quality*” (Table 1.) I first needed to generalize the idea of Fig 1, of the working principle, that “*patterns*” are generally vehicles for using networks of living things to serve networks of living things. That gave me various images of “satisfying” and “fulfilling” services to think about, that when combined with thinking about the energy released by “semi-lattice” intersections of services, to which living networks seem attracted.

3.2 Mining New Software Patterns

“ Learning from the Trenches”

Several techniques for mining software *design-patterns* from completed programs were explored by Hanmer & Mirakhorli (2014). My understanding of software is relatively limited, my experience mostly with old Fortran, Basic, Lisp, and Html, and not having professional training. The descriptions in the subject *pattern* for mining *patterns* from software assume recent professional training and experience, though. That leaves someone without professional coding experience like me little to go on. For example, they do not describe their strategies in a way that a generally informed reader might understand. They only state what they worked on and what it produced, albeit with care and summarizing with evocative terms.

3.2.1 The Approach

Their title “Mining new patterns by Learning from the Trenches” clearly suggests putting together clues to recognize hidden designs. They report using several methods, all appearing to be thorough, though not explained. More importantly, they seem to imply using fairly “exhaustive” search methods. When searching environments, exhaustive search is often the only way to find the boundaries you are searching within. Of their several approaches, the one I chose to focus on is called “Software Archeology,” a name suggesting a search through scattered parts for hints of hidden patterns.

- *Reader hints... For new subjects, we have to guess what they are all about. Almost any pattern is hard to see as a whole at first, the way it is meant to be seen and needs to work. Like trying to understand, getting hints only from overhearing talk in the hall, you look for hints of the whole likely to be later found in every part. To understand that “pattern knitting” you might think of times when you were quick to pick up on the pattern or painfully slow, and see if you can see why you asked the right questions some times and not others.*

Here we are looking for a response to their method pieced together from fragments of words and diagrams. Fortunately, both natural and intentional *design-patterns* are often found to have that kind of organization, where every part has features particular to the whole. That is similar to how any of a person’s signatures is recognizable, or the ineffable qualities of a neighborhood or culture are recognizable even out of context. Here there is some suggestion, for example, that the naming of patterns and the methods of identifying them was done quite carefully, and “by the same hand,” as evidence of an effort to use terminology that closely fits the intent.

There’s also the possibility that, though natural systems do not have “software,” of course, software is often mimicking designs from nature, designs that one could learn more from. Learning to identify and study the natural designs being imitated might suggest new ways the programmer could add living qualities to the design.

It also seems to be part of the general idea of *pattern-language* that patterns represent ideals of design that apply widely, implemented using one language, and discussed in another suitable language, independently. So when thinking of patterns of naturally occurring design, thought of as in “nature’s language,” we can potentially recognize and discuss them as referring to design ideals elsewhere, using any other suitable language. It is as one might discuss music in sign language perhaps, or geology in music. The limitation, of course, would be that of being able to refer to the same “ideals of form” shared so widely as if beyond language. Any language would express its images of the ideal that all would potentially refer to in common, though each somewhat differently.

So sometimes one might recognize a pattern as having the same ideal of design seen elsewhere, perhaps from scattered bits of partial information, and even succeed in finding apparent confirmation with more effort. So though software coding and forms of natural design are different in kind, if we can speak of them as exemplifying the same ideals we can study them as having related *design-patterns*.

3.2.2 Scheduling

The pattern mining discussion focused on the varied patterns for software task scheduling. Nature displays a variety of ways of “scheduling” tasks one can study too, getting things to show up when and where they are needed, and possible to recognize as forms of ideal *design-patterns*. Natural patterns of “scheduling” can seem mysterious in how successful nature’s seemingly disordered and inefficient methods of getting things to work together can be. Often they are highly complex and seem uncontrolled but still make mysteriously reliable and efficient ways of doing things.

Nature’s use of “wide scattering,” like “pollination” for reproduction or how species develop in large “populations” that can evolve when individuals cannot, are at the heart of the tremendous resilience in the design of life that we are only beginning to appreciate. It is the continuity allowed for those life systems is in the billions of years. It displays productive and efficient design somehow, that is far beyond what any human design for “optimal efficiency” could ever achieve. If we look around where that pattern of design appears, we find a great proliferation of highly productive ways of coordinating the working parts of things.

In nature designs for ‘scheduling’ material deliveries include simply scattering them, with no recordkeeping or targeting at all, which creates great repositories of “free stuff.” That is the basic principle behind the resource pools of ecologies and the circulatory systems like the bloodstream. They occur on so many scales they are hard to categorize, except as seeming to fill all the spaces in-between the centers of dense complexity of design and organization that uses them. They are marvelous at matching the diverse outputs of providers with the needs of users, scheduled transport of vast quantities of essential deposits and withdrawals, like pollen in the air for reproduction or the resources for ecologies. Their goods simply tossed out with no end purpose attached become tremendously reliable means of material communication with any user that comes along to use them. One can then gather that a design for providing services does only depends on what others will find useful.

The application Hammer & Mirakhorli presents neither shows how the types of scheduling patterns were found or condensed. It may be clear to trained programmers what the coding diagrams for them mean, but it is not discussed. To interpret them, one still needs to generalize the patterns they represent to start using “*pattern-search*” for associating them with related patterns found elsewhere. Here the suggestive words the authors chose can be used help search our experience for related examples in nature, to be validated in the end by the general usefulness of the result. So we mainly rely on the names chosen for the eight types of scheduling problems and associated names of the scheduling *pattern* types which the study found examples of (Table 5).

- *Reader hints... This method of “pattern search” takes a little practice, but once you get the idea, it is quite similar to the “free association” people love to do for fun, except that you keep track of the starting point as what you are making associations for.*

What they found were six general types of scheduling problems and distinct software *patterns* characterizing them. They also gave nice evocative names to both the problems and software *patterns* associated with them, but no statement or description of the patterns themselves. There was no discussion of why those names were chosen, either. The problems identified were generally named using *working-words* the *patterns* responding to them named using *center-words*. So to

look for naturally occurring designs to learn from one would first need to work backward from just the names, intuiting general natural *patterns* to use for searching for related examples from experience. We rely on imagining how the names imply the pattern's roles in their environments, to look for related examples we can learn from.

3.2.3 Software Archeology.

Hanmer's Software Archeology (2014) is described in Table 8, presented as the method by which the flow charts of software scheduling routines in Figure 5 were mined from a large software artifact.

The method for Software Archeology was said to use a combination of manual and automated software code search methods within a selected "large software artifact." Table 9 shows the results found in a prior study, from which the *design-pattern* in Table 8 was deduced.

That prior study was done "following three steps to analyze source code of several software systems to understand how low-level design decisions can be used to implement high-level architectural tactics."

1. "Archie [*their* 9] an automated design discovery technique to detect high-level design decisions known as an architectural tactic in several software systems."
2. "A *design-pattern* discovery technique [*their* 7] was used to identify the cases where architectural tactics were implemented using *design-patterns*."
3. "An overlap analysis was performed to understand forces and variability points across each tactic."

Perhaps the most important feature is that the pattern search appears to have been as wide and exhaustive a study as they were able to do, bounded by the diversity of the large resource available, and so defined within that natural boundary. It also reads as both quite carefully designed and intended for identifying all the scheduling patterns they could find, as exhaustive search. The care they took in stating what they did is also very clear, even if left quite unexplained. As we'll see the distribution of results also seems to have a natural

shape, even though they do not even report the number of cases of each pattern type.

Table 8. Pattern Name: Software Archeology

Problem: You have a large software artifact that you want to study to understand what patterns were used by its creators. You also want to see if there are new and interesting combinations of existing patterns that were used in its creation.

Forces: • You could hunt down the people that created the software artifact, but in many cases, you cannot find out who they are, or they’ve moved on and are not interested in talking about the old project, or they do not have the time to help you out. “Crowdsourcing to extract and document *design-patterns* could be done,” getting a group of people to jointly help.

- You have access to the source code, something that you do not always have.

- The documentation about how it was implemented, the design documentation, is unavailable. It might be non-existent. Sometimes it is available, but you are not quite sure if you can believe it, or it is for a previous version of the artifact.

- You are not undergoing the effort to fix a single, concrete fault. One’s goal is more of overall educational need. You want to understand the artifact to evolve it, or to assume ownership for it, or maybe to collect metrics for general software engineering research.

- You’ll get different information if you examine the code “at rest” or if you examine it while it is executing. Both kinds of information are useful and complement each other.

Solution:

Utilizing design discovery techniques to extract design knowledge from source code

These techniques are

- Archie: an automated technique to detect design decisions. [Mirakhorli et al., 2012].

- Lattix, Structure 101: Structure analysis tools to discover architecture from source code

- *Design-pattern* Detection Tools

- Source code analysis tools

You come up with a general outline of the patterns in the artifact. But it still requires human eyes to determine whether the pattern is useful, making it another place where “Crowdsourcing to extract and document *design-patterns*” can come in useful.

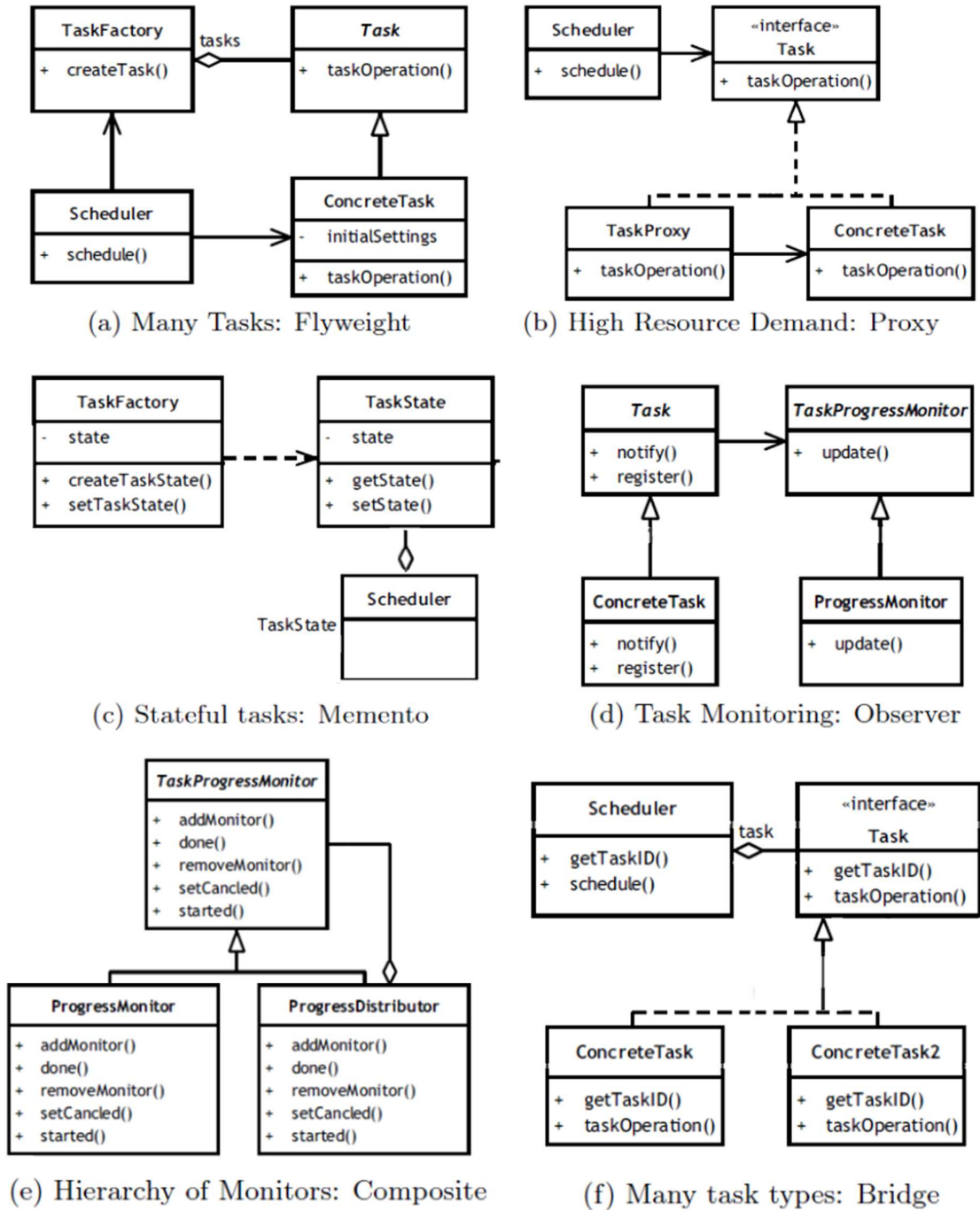


Fig 5. Software Scheduling Patterns found by Software Archeology

The names for the six kinds of software scheduling problems and patterns recognized for them are shown in Table 9. Flow diagrams of the types of scheduling routines found are shown in Fig 5. The process flow diagrams clearly show quite simple but distinctly differing organization, seeming arranged as ideals of each type. All in all, the results seem to reflect a natural family of distinct types of things. You might get about the same kind of group of characteristically different forms of stairs, doors, or fountains, for example.

Omitted in describing these distinctive discovered designs is, of course, discussion of the less distinctive ones, from the multiplicity of “other patterns” that are always present in the diversity of patterns found in complex kinds of organization. Those are harder to catalog as they are not easily sorted into clear types. That will most often be both because their kinds of organization are confusing or incomplete, or because of being highly organized and particularly individualistic. Those two kinds might be called “unpatterned” and “one of a kind” designs, both of which you commonly find in the often statistically large “tails” of the distribution in virtually all families of things. It is also a large field of potential study often ignored, perhaps not seeming to offer enough value for the effort.

Still, the six types of characteristic software scheduling *patterns* leave a clear impression as being found and named to represent a natural family. The name of the study and names of the *patterns* found are so suggestive too. So it seems possible that using the names for suggestion could help identify relations between software and naturally occurring scheduling *patterns* to learn from. Interpreting the *pattern* names as *center words*, thinking of their root meanings and associations with other circumstances, and using the *pattern search* technique one can use the *patterns* they suggest to find examples of others.

To help clarify the software archeology patterns, diagrams of the flow charts for the six main types are shown in Fig 5. To discuss just one example, consider scheduling *patterns* Table 9.6a & 6b (referring to Fig 5f)

6a - ‘Multi-task’ ‘One-step’ called *Bridge*

5b - ‘Multi-task’ ‘Multi-step’ called *Adapter*

The 6a multi-task *bridge pattern* might be compared with the *pattern* of “*restaurant menu*,” a single step in the whole service system of the restaurant. It bridges between talking to a waiter and telling them what you want. It is a

sequence with numerous smaller tasks, each of which tend to have a beginning middle and end. The 6b multi-task multi-step *adapter pattern* might be compared with “*restaurant waiter*,” as the visible face delivering custom services to each diner from the complex teamwork of food preparation in the kitchen.

H & M Software Archeology Patterns of Scheduling			J.H. Suggested Natural Pattern Types	
A.	a.	B.	C.	D.
Problem	Context	Pattern Name	Naturally Occurring Designs	Relating Property
1 Many tasks		• Flyweight	• Sweeper, Dealing, Dispatch, Batching	• Multiple or Frequent Small Tasks
2 High demand		• Proxy	• Producer, Manager, big team	• Complexly Organized and Costly Tasks
3 Stateful tasks		• Memento	• Cooking, Education, Politics	• Changing States and Forms
4 a Monitoring	Simple	• Observer	• Customs Check, Host, Bouncer	• Grading, Categorizing
	Complex	• Composite	• Impact Reporting, Rehab, Assessment	• Digestion, Accounting
5 Remote task		• Proxy	• Drone, Outsourced, Market, Insurance, Expert	• Reactive & Discovered Search / Access
6 a Multi-task	One-step	• Bridge	• Restaurant Menu, EBay, Market picks, Acquaintance	• Complex Choices
	Multi-step	• Adapter	• Sous-Chef/Waiter Triage, Fractioning	• Complex Performance

Table 9.

Software Patterns

Table 10. Natural Patterns

3.2.4 Natural Bridge Patterns

The diversity of items on a restaurant menu is a bridge between a diner and telling a waiter what they want. When ordering a meal, the choices on the menu are often fairly complicated and unfamiliar. Diners do like getting prompt attention and speaking with the waiter when they arrive, but they are also often

not ready to order at first. So they often glance at the menu and put it aside while they chat and think about how they feel at the time, needing to see what they are in the mood for. It also often takes time to adjust to finally getting to sit down and taking one's mind off getting there, all things the waiter needs to adjust for.

You might also need things from the pocket of a coat you checked, or to change tables so you'd see when friends arrive and things like that. Those are some of the "little steps" of "settling-in" that one generally finds between separate activities. Those steps for getting settled always make a big difference, too, both in satisfying the activity before and also the one after. In this case, they lead to the main bridge of understanding what is on the menu, usually with the waiter's help, and choosing what to order.

It is not only for "bridge" patterns but all patterns for services that begin and end that need "settling-in" to the newly begun or ended relationships. You may have first noticed that going to restaurants, but it applies everywhere, where the living qualities of letting the users and servers comfortably change relationships. It would be done differently for automated services than personal ones, of course, but the same applies. After ordering a meal, a diner's experience becomes periods of enjoyment punctuated with small tasks. They are mostly scheduled by the waiter coordinating with the complex work of the kitchen while serving other customers.

As a "multi-task multi-step adapter" the waiter becomes the visible commander of a diverse set of carefully prepared resources and practices for serving any combination of meals on the menu to be ready at the same time, to perfection, efficiently, perhaps for multiple tables at once. The work in the kitchen has to be coordinated to come out all at once, though the meals to be prepared may be very different. In a large kitchen, it is a scheduling task for the waiter and chef, sous-chef and prep cooks, for working smoothly as a team.

Here you can begin to recognize the secondary *design-patterns* needed for the kitchen to work. It is the special stocks and preps for making the meal and for the finishing touches added to both food and service that are so important for the whole service to be right. Those "tricks of the trade" are mostly not seen as parts of "the meal" but add the finishing touches that make it special. The "stocks" and "preps" ready to use speed up the preparation of complex meals and extend the shelf life of the ingredients, and make the service a delight.

How the kitchen staff works is to learn multiple roles, developing their own culture for organizing the ingredients and the work. It lets them approach each order more like an original performance, coordinated with the waiter, all so the whole operation can work smoothly as a reliable art of improvisation. On the waiter's side, the finishing touches of serving a meal may or may not change their tip, but can have a big impact on a guest's satisfaction, the *living-quality* of the room as a whole, and the likelihood of guests becoming regular customers.

It is possible that to a diner the scheduling task for a restaurant is a simple exchange of money for a checklist of food items. That is all you see. It is in how it is done that the living qualities of its operation for both its service user and provider become the real face of the design. It would seem to be both the simplicity of the pattern and attentiveness to good service built into each part that assures the whole runs smoothly and is truly satisfying. It is a matter of sufficient variety of responses (Ashby 1958), to fulfill the needs with a quality that honors all by approaching the ideal. In places that know and care about that, problems with the quality of service that arise are quickly noticed and the right changes promptly made.

The living character of a fine restaurant lies in its pleasing individuality in coordinating all its services to work together. That trait is also found in popular food carts too. It is a kind of *living-quality* of satisfying and unified service that is both common enough and rare at the same time. That quality is often experienced as pervading some locally thriving culture or as a person impressing you as "having it all together," as if that quality is flowing out along all the chains of connections inside and out. We talk about it as "sustainability" sometimes, and of its great importance, what Alexander seems to have also talked about as "the quality without a name" QWAN.

What we can write down seems to be ways to point to the ideal, not reliable formulas for it. Much of its achievement is contained in the loving touches with which good design finished, in the all-important finishing touches too minute to specify. It also has to do with what you might call the soul of what is being perfected, a quality coming from the inside of the things that have it. We can learn to point to it, as something to learn about and to use *pattern-language* to discuss and to find living examples. That might be enough.

The living qualities of responsiveness throughout a design are like the lasting character of good friendship, and of places that draw out the best of everyone who

participates in their culture. It seems that no part of such achievements is either unessential or unimportant, a quality of truly working as a whole associated with its individuality.

4 Background and Theory

4.1 General overview

Part of why a discussion of naturally occurring designs and their details might seem unfamiliar is that the sciences have largely studied controlled rather than the naturally occurring and uncontrolled designs of nature. Finding simple rules for what we can control has generally been much more profitable, as opposed to studying the actively evolving designs of nature that behave by themselves. That financial benefit assured that people would pay much more attention to understanding control, and relatively little understanding systems that developed independently. So the science preferentially studied just one side of life and neglected the others. For example, by focusing on fixed relationships to describe with rules of “cause and effect,” we neglected to learn about lively and changeable systems of relationships developed throughout nature. That also resulted in considerable language deficit for discussing “non-steady” types of change, as seen in the many kinds of emerging and lively organization and transformation, so central to systems of life. They do not follow fixed rules but evolving patterns of development, not definable using the scientific method. It is part of why scientific models and predictions seem “lifeless,” that the scientific method can not describe independently lively behavior.

The first step to learning about literally anything, of course, is to identify the subject. That is what *pattern-language* is primarily designed to let people do, identify complex patterns of relationships as recognizable objects of design and behavior. In professional usage, they are called “centers,” “objects,” or “designs,” sometimes identified as self-organizing physical systems. In informal usage, they are usually called by their common names such as neighborhood, profession, community, language, culture, or ecology. If the terms used work to identify the subjects, it is possible to speak about them scientifically, as evolving natural phenomena, as well as for their social, political, economic or design features, depending on what kind of questions are asked.

The general *pattern-language* method of inquiry would be to collect diverse observations of *contexts* and *forces* from many points of view and then like any descriptive science try to discover the systems of strong organization linked by

contexts of weakly organized mediums of exchange. Each profession tends to develop its own language tools and perspective. So far, a language for identifying and discussing the independent systems of society and nature is missing from the common languages of science.

The benefit is it makes it possible for groups of people to identify and discuss their issues regarding commonly recognized natural contexts and situations, identified as natural phenomena with human meaning. Information would expand in meaning as the subjects of interest became the natural phenomena we are part of. That recognition can lead to finding better ways of understanding the *forces* of concern and responding jointly to improve the quality and fitness of our environments. So all-in-all it builds a useful true conversation with nature, giving stakeholders a new common language. Where it originally comes from is Christopher Alexander's insight (1977, 1979) into how to write down and make explicit the kind of holistic design that artists and architects have done since ancient times.

It is a method that would help both professions and our culture learn to recognize the upsetting kinds of organization causing troubling change, and help them see how to respond. We'd certainly still pay attention to using fixed rules, where they apply, not usually the source of problems with disturbing change. Then it is more often a matter of discovering what is missing from the context and its relationships. In that sense, making things work becomes more about helping them.

4.2 Building on Alexander, Jacobs, Goodwin

My first introduction to Alexander's way of describing holistic *design-patterns* from multiple viewpoints was in the early '70s. I heard a talk on the historic evolution of public spaces, and evidence of accumulating pattern memory in their environments, when studying design at the University of Pennsylvania. How my mix of physics and design research on natural systems developed was indeed inspired by that and is discussed more in the companion paper (Henshaw 2015). I also became interested in how patterns of naturally occurring design also seemed influenced by the accumulating design memory of their surroundings, with every organizational artifact creating impressions in its environment. It would appear my main breakthrough was noticing that what defined such natural

systems was how they individually developed, a process with a beginning, accumulating complex designs in stages. That seemed to explain why they continued to reflect the patterns they originated from, not being information constructs at all, but built by an accumulative process of patterned design, growth.

When considered as building up from “seed patterns” of design, natural systems are no longer thought of as models for prediction, but as actual objects of locally emergent organization, making sense of why nature has so many kinds of individual things, all of them developed individually. So not being made of models of prediction, an alternate way of describing them is needed. My first way of doing it was to describe their accumulations as starting with small steps and building up to bigger ones to end with small steps again. It was what I called “an unhidden pattern of events” (Henshaw, 1979). That rising and falling pattern of change, though, may tell you where natural growth is occurring but not how.

English does not seem to have a word for design without a “designer” to use when the self-organizing growth process is itself the designer. All one can do is invent a new usage for a familiar term, stretching it a little, and call that self-organization process a kind of “autonomous system learning” and “building of design.” So having taken such a different direction in the early ‘70s, I did not follow Alexander’s main body of work as it developed (Alexander 1965, 1977, 1987, 2001-6.) but only recognized what it was long after when it was adapted for software development (Rising 1998, Tidwell 1999). It was when my work turned more toward global issues working on the SDGs the UN that I found educators and theorists contributing to PURPLSOC aspiring to make *pattern-language* a general science, that I noticed the match with what I’d long been doing (Schuler 2008, Bauer & Baumgartner 2010, Finidori 2014 2015).

As my work developed, I also learned a lot about natural forms of design from wonderful ecologists, various new science and systems thinking communities, historians, and storytellers too, of course. I was influenced by “deep ecology” as a discussion of the uniquely individual designs of nature, their individuality, and inherent worth. Brian Goodwin and Richard Solé are examples (Goodwin 1994, Sole’ & Goodwin 2000). I spent a lot of time immersing myself in and writing formal papers for other sciences too. Because I was describing natural system designs rather than predictive models, the people I submitted papers to generally did not know how to discuss or review them.

Of the others, I learned from I think the work of Jane Jacobs comes closest to talking of societal designs as occurring naturally. She is quite eloquent in discussing the evolution of cities and their economics as an animated organic process of accumulative design. The subjects she studied were the individual transformations of emerging design having recognizable patterns, whether it was the blights that beset mono-culture cities like Detroit or understanding the need of complex crosscurrents of culture for innovative technology to develop. She also focused on the living qualities that produce thriving communities and urban centers, how those cultures thrived and grew vigorously some places and were missing in others (Jacobs 1961, 1970, 2000).

Given so much in common with Alexander's view and *pattern-language*, it is surprising there's little evidence she worked with Alexander. For her, the creativity of cities and economies derives from a complex of overlapping organization, similar to Alexander's observation of the role of "semi-lattice" patterns in "A city is not a tree" (1965) as attractors for life. What unifies the two views is to see thriving urban centers and fine building centers as both developing more or less like natural systems. Both emerge from small origins that thrive and grow by a history-dependent creative process within a local environment.

The process of design in architecture begins with a concept for combining things to work too, and progresses by ascending stages of history-dependent discovery too, for how to fully serve the needs that inspired it. That is where, with luck and dedication, the creative emergence of new architectural form occurs naturally, proceeding by strongly opportunistic and history-dependent stages of design within a community of designer's. What I think maybe interestingly different between her approach and Alexander's, is Jacob's view of cities as living things themselves, composed of living arts and what those evolving arts built for us to live and work in. That is much like what I arrived at too, that natural systems have active and stable parts, the active parts building their capital infrastructure as stable parts, each shaping the other as they develop together.

4.3 A brief summary of methods

A general assessment of a *pattern* would begin with a general assessment and review of:

- its basic organization as a *pattern*,

- whether it is a “unifying principle of design.”
- is a unifying response to the *forces* identified,
 - for the real context concerned
- identifying all the *forces* to be responded to, and
 - for the varied circumstances where the *pattern* might need to be applied,
- verifying other assumptions as part of “taking a fresh overall look” at design, at any stage.

It also helps to review the resources one would have for looking further into *design-pattern* and the relationships than would connect a design made using it with its world. You’d ask things like:

- what else do the services provided ultimately need to serve,
- is there enough observation of the needs to understand them
- were the pattern resources consulted adequate, and where else might you look,

The *pattern* described in Table 1. “Mining Connections for *Living-quality*” is aimed at improving the *living-quality* provided by designs by improving the quality of services they provide. Two strategies were suggested:

1. Following the design’s connections to the living things served by or serving the design, to see if their needs could be better served with a better understanding of them.
2. Looking to nature for living examples to learn from, looking for related naturally occurring *patterns* of design, to find other hints to how the design can contribute to thriving surroundings.

The practice is to:

- follow the connections of the pattern to what they serve or are served by
- to learn more about how they need to work and
- to “look around” for what else might be needed,
- and use “*pattern-search*” to find related living examples for the whole pattern or parts to learn from and
- taking suggestion from how the ideal is satisfied in nature

One might start with doing it as a group exercise to bring out all the issues that can be, and follow with a “design studio” process, with individuals or teams preparing and then presenting their creative responses. This process of “mining *living-quality*” can be accumulative and reviewed at every cycle of a design process, as when using SCRUM or other Action Learning method. I usually suggest any design cycle include a review of what I call the 4Dimensions of sustainability, *Externalities*, *Internalities*, *Brightspots*, and *Total Balance*. *Living-quality* would be the 5thDimension. They each remind you to “look around” for what else matters, at each stage.



Internalities and Externalities: Every design is a *home* of one or another kind created to provide for the needs for some original way of living as is its primary reason for existence, and to filter external relations. During the creation and life of a home, there are continual needs to attend to internal and external relations, again and again; all focused on retaining the “sacred flame” of the life of the home. Whether it is a new arrangement of desks in an office or a regional redevelopment, everything visibly done outside is an extension of the more often invisible life of the home inside. A home is not a mechanism, then, and being a “good neighbor” and generating “goodwill” are valued commodities too, as opportunities to extend the *living-quality* the home is built *around*.



Brightspots and Total-Balance: Special needs and special opportunities can create concentrations of *living-quality* to enrich and color any design. Making sure there is an active *total-balance* for all of accounts and relationships requires serving the comings and goings of both the familiar and the unfamiliar ever-changing changing actors and roles that homes are part of. Looking for *total balance*, of course, implies having some way to look at the combined effect of the whole effort. There are lots of ways to do that, with all of them beginning with asking the question.

5 Great Pattern Repositories

The technique of *pattern-search* is great to use just for fun but mainly intended for searching great *pattern* repositories to find, study, and compare designs of all kinds in their working contexts. It is not an invention, really, but a refinement of what we do quite naturally any time we, for example, search for a word to use or scan grocery aisles to supply the kitchen. The big step is learning to use our situations and experiences with meanings to instead do the reverse, associate meanings with situations and experiences in life. That becomes a way to mine one's deep impressions of things to study and better understand the source of their meanings. For example, when hearing the words like "apple" or "door," we think of only the one meaning for them appropriate in the given context. We do not usually reflect on the experiences that give those word uses their meaning. The "door to one's heart" and "apple of one's eye" are expressions that hint at the deeper meanings buried in our emotional experiences with "open and closed doors," or with "ripe or rotten apples," both of which are very evocative of personal experience. The benefit is helping you to better understand the context and relationships to respond to.

There are more examples in the "*Pattern-search*" section 5.2 below and in the companion paper (Henshaw 2015). One can use the method to search any *pattern* repository for varied natural occurrences of any *pattern* or ideal. You can use it with Alexander's descriptions of his 15 *principles* of natural design (2002), for example, or his 7 design principles stated in his A New Theory of Urban Design (1987 p30), or to find living examples for understanding his overarching ideal of growth as a process of design, which he states so nicely in the introduction there:

"When we say that something grows as a whole, we mean that its wholeness is its birthplace, the origin, and the continuous creator of its ongoing growth" (1987 p10)

5.1 Human Culture

We often speak of “cultures” and cultural differences referring to the visible styles and manners of ethnic communities. Human “cultures” are much more than what is visible, though, and deep and wide repositories of patterns of life to explore. Our cultures are actually the entire package and containers for all our accumulated ways of knowing and living. We rely on them entirely to live as social beings and find how to connect, using our deep intuitive understanding of them. It makes our cultures our greatest and most accessible deep reservoir of natural *design-patterns* and ways to get along in life.

As whole systems of living, cultures are ancient accumulations of responses to natural patterns and our human experience and responses to them, a great record of memorable and important learned interpretation. To use it as a guide to natural patterns any cultural artifact can be turned around for helping you find the kinds of natural patterns the artifact is a response to, and then better understand what the artifact means to us.

You might see a bridge and think about why it is we like to make bridges so beautiful. One would also look up, and value objective research on the history and roles of cultural expressions, like archeologists do exploring the meanings of our past. It adds to the meaning of any present-day design to better understand what it is a response to, and so be better able to know how to respond to it today. One would, of course, look at different kinds of cultural artifacts in different ways, using differing methods perhaps. The general intent is the same, to use the meanings we have for them to guide us to a variety of natural circumstances where we can look more closely at what our meaning is a response to. As a repository of natural patterns, human culture is exceedingly complex. Below are sections on ways of searching “Stages of Growth” 5.3, Habitations 5.4 and Natural Language 5.5.

Our understanding of our own cultures is deep and rich, containing all our “tacit knowledge” (known without thinking), and part of all our thoughts and doings. Searching our thoughts for the natural circumstances that our conscious thoughts tap into, makes us more aware of what was hidden and subconscious. For various domains, we might need other methods, of course, such as working with others to broaden the exposure. Every family, business, institution, and community, as well as every person individually, is a great storehouse of ways to

organize life that grew from the common roots of human cultures. Some access to it is as easy as just asking good questions, paying attention to how relationships change when pausing to think about why.

Any culture is like an iceberg, though, having vast hidden depths and structure you can only learn more about by building up one's patterns of searching it. As soon as we're born, we start absorbing our family and neighborhood cultures, making our versions of the million-year-old ways of knowing and living that every family, community, and society passes on. Our way of living then becomes a pattern of how to live to be a model for others, continually refreshing the accumulative record.

If you pay attention as you walk any city, town or village you notice the local designs of life-changing from one block to the next, in the differing designs, materials, values, styles, and manners. Stories in the news often show how alien other cultures and communities seem to be, usually showing uninformed external views of internal cultures. All cultures have common roots, but then each makes its version. Simply recognizing this natural pattern of variation reminds us that they all display individual expressions of our own deeply ancient roots of "how we live." It makes everywhere you go understood as a place richly endowed with ancient knowledge. Each cultural world at any scale is also then a concentrated repository of its ways of living, its *center* and *pattern-language* for how to live, book more likely to open if interested in what it says.

5.2 Pattern search

"Pattern-search" is the use of one pattern to find examples of similar ones in different contexts, like using the word "cup" to explore all the ways of "cupping" things. The process includes 1) the pattern example you search with, 2) the pattern repository you search in, and 3) the search strategy you follow to look for related examples. If you watch people or animals, you most often see them visibly searching for things, nearly all the time, repeatedly searching for one thing after another, searching with a pattern, in a context, and with a method. Sometimes you can see people or animals visibly following a trail, or looking for a trail, "connecting the dots" as if following footprints looking for a lost key (Fig 6). Search may be for finding suggestions too, like searching for parts to add to

something one is making, considering things that might work, but not knowing what they are looking for otherwise.

As the search ends or reaches a stopping point, we generally relax or search for something else, sometimes adjusting the mental pattern of what we're looking for again and again, as in a learning process. The active process is that of shifting our attention from one subject to another until we are done and satisfied or disappointed.

A general pattern in mind to search for



Fig 6. Pattern-search, a pattern for finding patterns

Table 11. Design-patterns to Recognize

1. Trails of <i>Patterns</i>	the 'stigmergy' of nature
2. Stages of Growth	the working steps of transformation
3. Habitations	the organizational centers of life
4. Natural Language	reference to naturally occurring designs

Doors to Key Natural Pattern Repositories

Table 12. Form mental patterns of what to search for:

- a clothing image when shopping,
- a particular letter when searching the keyboard,
- an image of a shoe to fit, looking connecting parts, etc.

-
- any simplified pattern, to search for related ones.
-

For Scanning the Environment for Related Designs

The *pattern search* used by Harasawa et al. (2014) for finding how to illustrate *design-patterns* was to find suggestive words to represent the pattern and prompt illustration images. That fits the general model of *pattern search* very closely, first simplifying the pattern to be illustrated then casting about mentally for images. To expand on that for “mining *living-quality*,” natural pattern repositories are using empathy for providers and users of the pattern. These open-ended search methods have various added benefits too. Principle among them is assuring fostering exhaustive types of search, and producing a profile of the domain searched to help with understanding it as a whole.

Table 13. Expanded search for illustration images

- *center-words* found in the pattern description
 - *center-words* from what users and providers would say.
 - in what the design would mean to users and providers, and
 - and searching for naturally occurring examples to learn from
 - with the added benefit of emersion experiences fostering transformative change.
-

For Discovering Related Designs Wherever You Look

Growth can seem to take forever to start and then slowly develops a tremendous urgency for bigger and more rapid changes, taking it is small “Start-up” pattern to then propagate furiously in the “build-up” period. Then the urgency changes, to a need to “reorient” and come to terms with the natural limits of explosively reproducing designs. They can fail to have an end run, and so not fulfill their promise of completing a great transformation (Fig 7).

5.3 Stages of Growth

In Fig 7, notice the dynamic shapes of these classic non-linear growth curves, what is called “exponential,” after the exponents of similar equations. It is a pattern of change that accelerates with increasing scale at first, rising faster as it gets bigger to reverse the pattern and rise more slowly to approach its climax. The

organic meaning is that one is a pattern of an emerging system exploding with new parts, the latter a of it as a maturing system, stabilizing and refining its parts. Sometimes those same shapes are called “positive” and then “negative” “feedback,” also called “logistic” or “S” curves, also for the math to imitate the shapes of natural growth. What the math invariably leaves out, however, is the complex organizational change taking place that in particular radically reverses course in the middle, at the point where the curvatures reverse.

Growth as The Pattern of Transformation

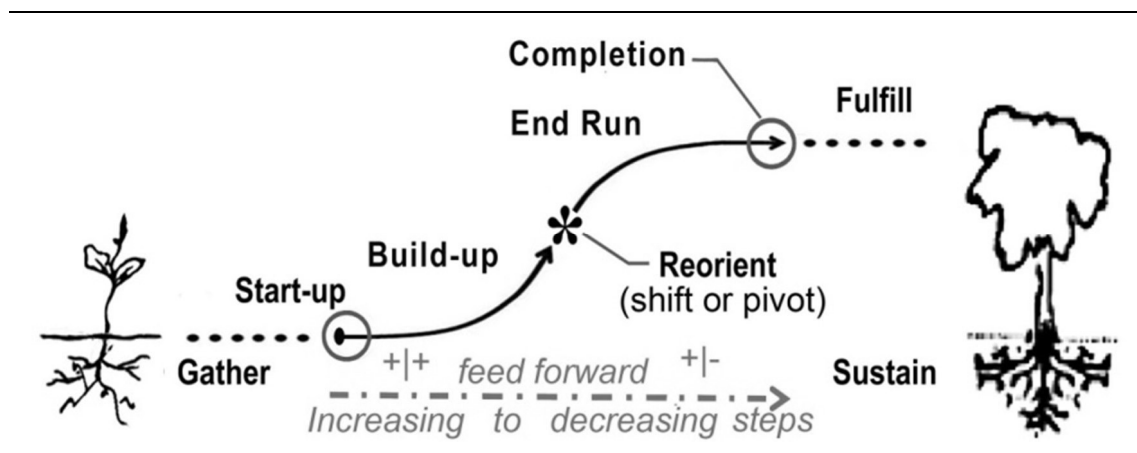


Fig 7. The stages of living system emergence

That natural growth cycle is a highly visible pattern in both personal growth, social change, and in local environments, displaying much about how individual transformations in complex systems of relationships take place. You see it as a general pattern of transformation for businesses too, political systems, and economies. All follow the same general pattern as found in the growth of plants and animals from fertilized seeds and eggs, all starting with an eventful burst of development. It is also the pattern of transformations in professional practices of all kinds, design, art, and business projects. They all startup with some new way of getting things to work, taking off, going through immature stages, and then mature development climaxing with whole system resilience and readiness. (Henshaw 2015 2.1 The natural process of design).

For mining living quality growth patterns are another of the very visible naturally occurring designs that are wonderful to use as guiding patterns. We're familiar with “start-up's” being immature and clumsy at first, and get more

response than they can handle, and called “a flash in the pan” or “blow out.” We experience much the same thing in relationships that get “too hot not to cool down” or all sorts of business and political efforts that “overshoot.” All along the transformation path there are characteristic stories to mine for what matters in the process of accommodating the change taking place, to learn from using *pattern-search*.

People do generally use their awareness of how things progress to gauge how to proceed with their projects and designs. Studying natural transformations as guides helps expand and deepen that kind of insight, to more clearly see when it becomes critical to start new directions, stop wasting time, or open up the work to review. Part of what is of greatest importance to understand is that these cycles of emerging change are just external observations of an accumulative internal organizational process, adaptively adding structures onto organizational foundations in the process of starting and finishing an emerging design. It makes growth a true evolutionary building process making complex transitions in a single leap. We can partly follow it and mark its critical stages, taking noting the variation of its rates of change. All the following steps rely on the preceding ones being sound enough to build on, and the preceding steps rely on the completion of following ones to endure, like the emerging design extending roots before using up the available seed resource.

The greatest value, again, is how it changes the perception of the design process, recognizing the process of transformation and its design as a whole, as it moves together from stage to stage toward completion. To notice what is happening, one needs to follow a natural storyline, a development narrative with continuity to connect the transformational stages. That is what following the natural transformation timeline from immature to mature design is for. It lets you organize one’s observations by the natural stages defined by the developing system itself, to have mental dimensions of progress corresponding to nature’s, and letting an observer fit the ascending then descending scales of steps together.

Beyond the scope of this paper to discuss, but worth mentioning is the study of surprising departures from the normal progression that any pattern miner would quickly notice as places to look deeper to discover what is happening. The record of mid-twentieth century US economy shows a growth system and its parts all

regularly growing together and then abruptly splitting apart (Fig 8)⁵. The whole maintains steady growth and the parts all hit limits. You could begin to understand it more broadly by closely studying the 1970 implied event, or use pattern search by generalizing the pattern and looking for other examples and cartoon images of systems growing rapidly as a whole and leaving behind most of their parts. You might see this kind of curve in sales data for a company with several products, with one ‘disruptive’ performer marginalizing all the rest.

Growing together till 1970, and then abruptly growing apart



Fig 8. Reading Transformations for systemic reorganization

To use *pattern-search* image compare it to the US profiles of people the data reflects. You might ask what the disruptive product that seems to have taken over was. You might imagine that the divergent performer scavenging resources from the others, (to check the opposite view, perhaps developing a new platform for them). You need to look at all the possibilities to understand the “wicked

⁵ Fig 8 shows US data from BEA sources, GDP accumulated from 1860 and median income percentiles from 1950, indexed to GDP at 1970

problem” it seems to present⁶. Systems drained of resource lose resilience, for example. Does the jittery movement and divergence of the income levels might suggest a lack of resilience that is supported by other observation? A failing ability of the parts to share resources for responding to each other's needs is another symptom of systemic loss of resilience. Is that seen in other observations?

Reading the informative shapes of growth curves starts with recognizing the continuity as reflecting the internal behavior of a continuous process, here moving altogether, and then not. This method originated with a wide range of studies of transformation processes and analytical methods for clarifying the data showing them, as a work of natural systems physics⁷, on which this *pattern-language* method for exploring guiding natural patterns is based.

5.4 Habitations

As mentioned in 3.3 above, the natural *design-pattern* of “homes” is found universally as a place of concentrated organization and center of life. It seems not yet studied as either the functional “system design” and “business plan” any individual way of making a home is. Living systems make their homes in any place they can find and produce designs of tremendous diversity. Sometimes they use structures, other times just made as niches defined by habitual ways of using an open environment, often ingeniously arranged to avoid conflict with others, allowing 1) protecting the individual way of living inside, and 2) serving as a center of operations for outside relationships, mediating the ‘Oikos’ and ‘Polis’ as the natural ecological centers of life.

We find "homes" in the form of “houses” and "dens," but also “bodies” and “cells” as homes to their living interiors, and ecologies as homes to cultures that are in turn homes to their culturally connected inhabitants, all somehow highly organized complex living systems of living individuals. The organization of human culture is organized around homes of every scale too, with our complex differences taking very diverse roles in connecting each home’s internal and

⁶ See also research letter <https://synapse9.com/signals/2016/05/26/did-1964-sec-rules-wreck-us-economy/>

⁷ The Physics of Happening – an archive of original research on transformations <http://synapse9.com/drwork.htm>

external worlds. Fig 9 illustrates the basic relation of homes and environments, illustrated as cells with their individual interior way of living, that have co-evolved to exchange deposited and withdrawn products.

People are at home in their offices, their towns, their houses, and in their social and professional groups all at once, and find it easy to switch from thinking about the differing issues of each. The details of what they need to offer differ from one to the next, but the patterns are fairly recurrent and familiar to us. They are usually recognizable from the form of enclosure, private interior space and presence of an interior culture, though what is going on inside not possible to see. A group of friends that forms a variety “hangouts” where they can get together any time they want goes through the same basic steps of securing their private domain, where they can live the way they want, defining their own “culture.”

A “community,” “business,” “society,” or “ecology” does the same. Most kinds of habitations can be recognized by the forms of their boundaries. A city does not need a wall to be defined by its internal cultural units. The boundary of a culture is whatever is “in the loop” in that case, seeing the whole as its center. That makes it bounded by its self-sufficient system of internal connections, separated from its surroundings by its surrounding niche of exterior services and connections. The same ecological pattern of self-sufficient designs with one center is found in many other forms, such as “economies” and “societies,” “professions,” “craft trades” and “social networks.”

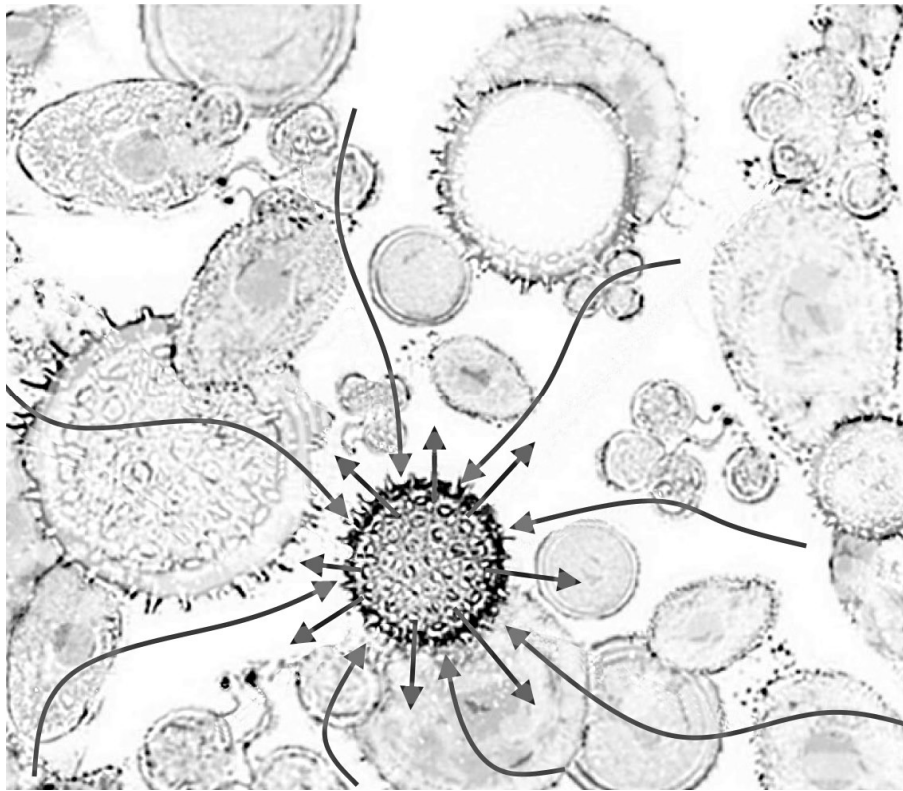


Fig 9. Homes and their selective external connections

Each develops its own defining internal connection culture. Individual family homes develop their distinct cultures, for the densely connected “hive” of activity central to its *design-pattern*. The same way of locating the boundaries for centers of self-organization also applies on even smaller scales to “teams,” “clubs” and “groups,” all seen as creating a mostly “exclusive space” in a greater “inclusive space.” It is a kind of complexity that does not yield easily to being “diagrammed” as it has much too much variety of independent associations even to be categorized. So we need to rely on recognizing their individualistic patterns and individual internal cultures.

The connections between individual homes or cultures also selectively filter entry to the interior, requiring any outsider to respond to the local culture and take a role in it to be welcome. It also applies to all other kinds of connections between homes; filtering the exchange of goods and services for their fitness. Entering any unfamiliar home, that of a person, a business office, or government agency requires much the same preparation for crossing into the unknown. Sometimes it

is easy to participate in the life of other neighborhoods or families, other times not, and always a limit to how far one's welcome extends, that can be tricky. Trying to act as if you belong where you have never dared to try before can be a life-changing success or a crippling failure. Even studying how someone else lives, to recognize their patterns could either make you more welcomed or seem nosy and pretentious, and you might never know which.

What is prominent from inside of any home is a way of living mostly invisible from the outside but still sharing in the common culture for its outside connections. These networks of private worlds serve as a great reservoir of individual patterns of life, though. They are places where old ways are stored, and new ones are free to develop. Why this fairly obvious and important pattern is mostly left out of the public conversation is that these are mostly subjects of private conversation, much of which is non-verbal. The conversations on business cultures open the subject some and become a good pattern repository for understanding public/private relations. Of course, it is also a great conversation topic within the family or a circle of friends and expands their cultural awareness.

Because we generally do not talk about them, however, it does also leave large deficits in our public understanding of how home cultures and their relationships work. With its focus on *centers, forces, emergence, and balance*, a *pattern-language* approach offers a neutral way of being explicit in describing the holistic ecological *design-patterns* of homes and their relations. That makes the design of life far more recognizable, from multiple points of view, and might relieve some of our natural, cultural deficits in understanding the world in which we live.

As a universal natural pattern, homes can be recognized as having a variety of other important common features of living things. They generally have internal economies, essential to maintaining their resilience, for example. So they also have a form of "business model" for internal and external transactions too. To work with them, large and small, and understand what services they need and can offer, some way of recognizing their hidden designs without intruding on them is part of the challenge. Even what is called "meta-data" can be intrusive and needs trust to be made good use of. To enhance their connections from the inside is another way, supporting homes in learning about their environments, so their internal economies can make better connections.

Learning to work with a world made of these varied and individual cultures is a major challenge, as well as perhaps nature's most important gift. It is also important to understand how our public cultures rely on and get their vitality directly from their diverse kinds of home cultures. Because of the verbal culture's inability to verbalize their issues, though, adds to a variety of other reasons why they are often acted on in ways that that harm them. So a way of recognizing the *design-patterns* of homes, and search for ways to bring them *living-quality* seems very much needed. That they are naturally connected through their work, and directly affected by the patterns of service user and provider designs for their work, offers at least a conceptually practical way to bring *living-quality* to them directly.

For mining *living-quality* to enhance the *design-patterns* we work with, the simplest idea is that designs work by connecting the services of one home with another. From both sides, the *living-quality* of those connections is found in both the suitability of the intended service and in the little things that make each party feel at home with it, responding to their complex needs. For example, one can ask if the loading dock has a pull-down seat where a driver or workman can wait. You could ask if new software has a place in it for making notes on how to use it, or whether online forms offer people copies of the documents they fill out. Well, it seems those inexpensive luxuries are rarely found because the designer did not think to suggest they might smooth the whole operation.

There is more on the nature of homes in the companion paper as well. One develops one's way of exploring these complex relationships by "looking around." When you see patterns connected in interesting ways, you naturally "look around" to collect impressions of what is happening. Alexander's way of writing does not refer to "homes" particularly, but his use of the term centers seems to overlap with ideas of homes as well as with his general idea of wholeness, home being a definitive place where you feel whole. I refer to "wholeness" sometimes more literally, as actual completeness of organization, though I also like the aesthetic quality of wholeness as an emotional feeling about designs, as it seems Alexander and others more often use it.

Where the two overlap seems to be where the "completeness of organization is so strong, it gives you that undefinable feeling, such as when asking where

natural designs that work and act as a whole come from. There's no place for such naturally occurring designs to have come from, except by developing as a whole from the start! It is also readily traced in the way whole systems develop from their starting seed pattern for many things. It is hard to explain, what it is that starts from a "seed pattern" such as a "handshake," to start things on their course, but that is as close to the beginnings of them you can observe. Not incidental, of course, is that such physiological systems would need energy, and would need to find a common way for the whole to build up around a way for its economy to use energy, along with other resources.

David Seamon made an interesting study of Alexander's contribution to the phenomenology of wholeness. He portrayed it as integrally related to other living qualities, of beauty, eloquence, good health, wellbeing, vitality, and life (Seamon 2007). All of these associations relate to things in the natural world that one can interpret by studying their parts, and how they relate to other things, but he thought not extending to the meaning of wholeness, saying:

"The great difficulty, however, is finding a way to move into and encounter the parts as they are in themselves so that the whole will be foreshadowed and seen, more and more fully. How do we encounter the parts most advantageously so that we can better see and understand the whole? "

"Most simply, phenomenology can be defined as the careful description and interpretation of human experience. The focus is on phenomena—i.e., things or experiences as people experience those things or experiences. The aim is to describe any phenomenon in its terms—in other words, as it is as an experience, situation, or event in the real lives of real human beings in real times and places." (Seamon 2007)

My approach to the same problem is to recognize the quality of 'wholeness' as a both a perceived property related to a natural property to the things that we use the word to refer to, not independently defined as a mental concept, but as a partial awareness of a natural property, that a good observer can develop further. I come to that from associate 'wholeness' with the observable things we recognize the ideal property of wholeness expressed by, those delightful people, places and things that change the experience of the rest of the world. Things that grow as a whole and display fitness in their world and contribute *living-quality* to their

surroundings are very common, and often possible to imagine or try out how the world changes with and without them.

I suppose there must be some reason for Alexander and others discuss wholeness so abstractly, though I find its material reality far more important. So it seems there must be some value to both, and one should not be replaced by the other just for convenience. But that does not keep people from studying the various things that seem to elicit feelings of wholeness, a genuine emotional state, as either a powerful abstraction or direct experience.

5.5 Natural Language

Perhaps our deepest and richest repository of natural *design-patterns* is our natural language. Words refer to the things of life we engage with and talk about. Our cultural associations with the words originated from those life experiences, our common words having extremely ancient roots, carried forward for thousands of years. Their meanings are continually being refreshed with new experience too. Our common words very often directly refer to the recurrent natural *patterns* of relationships we thought were important enough to name and attach our values too, and with the impact of words like “door,” “storm,” “mine” or “heavy.” So our great familiarity with our language is at the same time a great familiarity with our named ancient experiences. Familiar words can direct attention to diverse examples of things related to the experiences from which the word comes and gives a name to. That association between a name and range of related experiences are held together by the distinctive *pattern* of relationships common to all, and the experience of them recalled. It is a repository of natural *design-patterns* people already knows much about.

That said, modern people also seem to have often less need for understanding where the meanings of their words might have come from. We are surrounded by and immersed in words defined abstractly, referring to rules and theories from one philosophy or professional practice or another, that slip into popular use with whatever social meaning those terms seem to have, often different from every social point of view. Often the terms are borrowed from natural language too, but then come to be used essentially like slang, giving us great freedom in shaping our conversation, but not referring to the natural world we live in.

Blandishments aside language does not normally redefine its roots, which mostly come from experience, as frequently as modern word usage seems to break the continuity of words with their roots by using them in altogether new ways. The natural meanings are still there and hard to erase, but our decisions do seem to be made more and more in terms of words redefined for commercial or abstract notions. So learning more about the way natural language refers back to its roots, pointing directly to recurrent natural *patterns* that have common experience for all, seems like it may come in handy. It could enable us to become more knowledgeable designers, and students, and voters, and partners in our spinning world. It might be a way for anyone interested to become more aware of the important differences in relationships that produce the *living-quality* our designs need.

Simple and obvious examples of words for natural designs, like “rock” as being one thing and “fire” as being quite another, or “butter” and “love” as quite different aspects of nature, are not “theories.” They are ‘names,’ and refer to real things. When taken out of the contexts we usually find them in, used abstractly in commercials or for jargon, their rich original meanings can be lost.

There are lots of ways to experiment with using this approach to accessing our cultural knowledge of natural designs, and some basic techniques to be familiar with. One is the somewhat high-level use of *pattern-language* as a tool to explicitly describe holistic *design-patterns*, such in Table 1 and in the other references. The simple heart of that technique lies in neither starting with a solution or a problem but starting with a listing of all the “*forces*” in a context that needs to be worked with, looking for them from all directions. A common result is that mining the *natural patterns* and *living-quality* behind the words found for describing the “*forces*” and structures for balancing them, leads to discovering important relationships in the context that never would have been noticed otherwise, and change the full understanding of the work at hand.

That general practice of mining the *natural patterns* behind the words as a guide to working with nature has four steps:

- 1) take interesting words or phrases of interest out of context (to free them of assumptions)

- 2) look for the experiences and subjects associated with them, from direct memory (or thinking about the variety of uses and from the context the associated experiences and subjects).
- 3) examine the what life circumstances and relationships the term refers to, (like “shivering” refers to a special uncontrolled shaking)
- 4) associate the ideal of the natural *pattern* found with the ideal of the experience recalled, to understand the meaning of the word.

Then when that word is used in the discussion of the design, it is that deep meaning of it that is referred to. Added discussion methods are in the companion paper (Henshaw 2015 4.2, 4.3)

The most surprising thing is how surprisingly fruitful these methods can be for even common utilitarian words. Simple examples might include common object names like “road” or “hat,” etc. Such common words often are among our oldest terms, associated with the earliest experiences humans thought to name, and so have unusually varied use and deep meanings. You can often speed up the process of understanding their deep meanings by looking for their varied uses and looking up the etymology or use in old books or dictionary. For common uses of “road”, for example, which exposes an unexpected tapestry of uses, like: “hit the road” or “the road to ruin”, “road to heaven” as well as “road home”, “off the road”, the “easy road” and the “long road” etc. As you see that fan out as a pattern, you fairly quickly get the idea we’re not talking about asphalt.

When I noticed that array of evocative uses for ‘road’ I looked it up in Webster’s 1903 Unabridged Dictionary⁸. There the first two meanings are: “that on which one rides or travels” and “journey, or stage of a journey.” It seems why all those different meaning-filled uses connect to the same humble root word is are connected by the common natural life *pattern* and experience, with added complex understanding of it over time. In this case, the relevant root meaning of “road” seems to be that of something that leads and guides one’s travel, with a great diversity of important choices to be made about what is hidden in the distance along the way (Fig 10).

⁸ ARTFL online Webster’s Unabridged 1903+1828 dictionary
<http://machaut.uchicago.edu/?action=search&word=road&resource=Webster%27s>

The road taken



Fig 10. A Journey as a long path of discovery

Using other kinds of dictionaries would bring out other meanings. One can look for all the compound words ending or beginning in “road,” or having other prefixes and suffixes for it⁹. That turns out to be a great way to discover the wonderful increase in complex meanings for western languages from Latin. These ways of searching for the deep hidden meanings of words and naturally occurring *patterns* and experiences could also be a way to expand and enrich other searches, like those discussed in 2.1 & 2.2 in commenting on Hawasawa et al. (2014), or Hamner & Mirakhorli (2014).

For another example, you might wonder what forces are balanced by a “bridge” *pattern* while looking for naturally occurring examples of bridges looking for solutions related to it. You might find that “bridge” is also a “transition” or “transformation,” for example, opening up a tremendous variety of forms of “bridges” to study. It would expose the vast variation in bridges there

⁹ OneLook dictionary: “states of being” in “-ence” words
[http://www.onelook.com/?w=*ence&scwo=1&sswo=1_*road & road* words](http://www.onelook.com/?w=*ence&scwo=1&sswo=1_*road&road*words)
http://www.onelook.com/?w=*road&ls=a http://www.onelook.com/?w=road*&ls=a

are, and how very particular to the functional passages from one environment to another they connect often are. One runs across these revealing very general *design-patterns* unexpectedly sometimes, having begun a search from one starting point and leading you to many connecting or contrasting meanings. As you go, you'd look for the naturally occurring *design-patterns* the words are referring to ground one's meanings you are searching for. As discussed in Section 5.3 almost any *design-pattern* one works on has something to do with "homes" for example, and so also with "enclosures", "separations", "continuity", "flows", "resilience", "development", and all the many other common words associated with natural language having originated from ingenious observation of diverse and complex meaning in nature.

6 Review & Conclusion

In §1.0 the paper introduces a *design-pattern* called "Mining Connections for *Living-quality*" (Table 1), and in §2.0 demonstrates practical methods for better understanding any *pattern* and its connections with life, to check its validity as a design for using and providing services and enrich it with living qualities found by association with related living examples. In §3.0, a general background in the theory of *pattern-language* as a scientific method is offered. In §4.0 a variety of natural *pattern* repositories and methods of using them are discussed. In conclusion, learning to recognize and use guiding *patterns* of naturally occurring design can enhance the *living-quality* of designs of all kinds, and also offer a variety of extra benefits, from being a useful way one can reground language in a confusing time to enriching the meaning of experience in general.

6.1 Introductory Topics

- Suggestion to readers for how to pause and develop their thinking on the subject, general terms and
- *Pattern-language* as a study and description of ideal invariant qualities of recurrent designs, using natural language
- Background on origins of the work and pedagogical choices.

1. Mining Connections for *Living-quality*

- The general role of *patterns*, designed as bridges connecting their serving and served networks of the environment is the context
- Introducing the *design-pattern* for “Mining *living-quality*” for validating and enhancing the services application *patterns* provide to their worlds.
 - Features and terminology added for describing naturally occurring *patterns* of design
 - The two principle solution strategies to be demonstrated and discussed are:
 - searching in the *design pattern*’s external connections for the service user and provider needs to see how well they are served, looking for unserved primary and secondary needs.
 - using the pattern being worked with to look for varied naturally occurring parallels to learn from, exposing how thriving environments work.

6.2 Application Examples

Topics Using PLoP 2014 Studies

- For the method of Harasawa et al. (2014), a pattern for developing images to illustrate *patterns*, identifying categories of “*center words*” and drawing from them an image with “*living structure*” to illustrate the pattern

- Comparing with the method of illustrating the pattern of Table 1 for this study, very similar to Harasawa’s but using wider and varied methods of natural *pattern-search*,
 - The one real difference was the latter being “outward” in its search approach, looking for meaning how *patterns* interact with their environment, and the former more “inward,” in drawing inspiration from the teams own words
- The method of Hanmer & Mirakhorli (2014) for searching software collections to find variations on programming *patterns* was discussed, as using a mix of computer-automated search and manual review
- Demonstrating the use of the evocative names chosen by the authors to explore the rich world of related natural *design-patterns*.

6.3 Background and Theory Topics

- The need to fill a deficit in our language to discuss the non-steady state but highly organized *patterns* of naturally occurring design,
 - resulting from science not finding how to describe those natural designs with equations, leaving them mostly unstudied and generally undiscussed.
 - *pattern-language* appearing suited to describe and study them, as a practice of studying the organization of working relationships from many views
- Some background on how this work and Alexander’s followed independent paths having begun in the same general design community in the ’60s and ’70s
- The diverse and rich natural pattern repositories available, principal among them our own ancient cultures as the record for of all our knowledge of “how to live.”
- The ideas of environmental search, using a generalized pattern to search for examples
 - Searching outward along connections with an environment

- Searching globally for living examples of a pattern to learn from globally
- The challenge presented by living systems developing and acting from the inside, hidden from view, and internal organization allowing them to behave cohesively as a whole,
- change by processes of the whole that accelerate and then decelerate
- inter-dependence between the active parts and the *patterns* of design that result in how they use their the environment.
- emergent properties from connecting oppositely fitting parts

6.4 Great Pattern Repositories Topics

- The general idea is to search for guiding designs of nature using word association backward, to direct our attention back to the compelling natural experiences our word meanings came from, to study why they were important enough for us to attach to words.
- Introducing methods of *Pattern-search* and use of great pattern repositories of Culture, Stages of Growth, Habitations, Natural Language
- Four important types of natural *design-patterns* to learn how to search
 - Trails of *patterns* the ‘stigmergy’ of nature
 - Stages of Growth the working paths of transformation
 - Habitations the organizational centers of life
 - Natural Language a rich general reference to recognized naturally occurring designs
- How to do *pattern search*, by using a more general pattern than you start with
- How recognizing stages of growth exposes changes in design
- The great range of kinds of homes and ways to observe their roles and changes

- The wide range in kinds of deep meaning you find in the natural relation between the words of our language and the things of nature we talk about
 - Methods of language search and root pattern discovery

JLH

‘Living Quality’ Figures and Tables List

Figures

<i>Fig 1. Flowing connection</i>	<i>6</i>
<i>Fig 2. Steps of Composing the “Living structure” and Illustration</i>	<i>18</i>
<i>Fig 3. Chosen illustration “Language Shower.”</i>	<i>19</i>
<i>Fig 4. Liveliness.....</i>	<i>20</i>
<i>Fig 5. Software Scheduling Patterns found</i>	<i>27</i>
<i>Fig 6. Pattern-search, a pattern for finding patterns</i>	<i>43</i>
<i>Fig 7. The stages of living system emergence.....</i>	<i>45</i>
<i>Fig 8. Reading Transformations for systemic reorganization</i>	<i>47</i>

<i>Fig 9. Homes and their selective external connections</i>	<i>50</i>
<i>Fig 10. A Journey as a long path of discovery.....</i>	<i>57</i>

Tables

<i>Table 1. Mining Connections for Living-quality</i>	<i>10</i>
<i>Table 2. Template for Describing Intentional Design-patterns</i>	<i>11</i>
<i>Table 3. Template for Describing Natural Design-Patterns.....</i>	<i>12</i>
<i>Table 4. Working-words (how it works).....</i>	<i>17</i>
<i>Table 5. Composition Words.....</i>	<i>17</i>
<i>Table 6. Element Words.....</i>	<i>17</i>
<i>Table 7. Steps of Pattern Illustration</i>	<i>18</i>
<i>Table 8. Pattern Name: Software Archeology.....</i>	<i>26</i>
<i>Table 9. Software Patterns.....</i>	<i>29</i>
<i>Table10. Natural Patterns</i>	<i>29</i>
<i>Table 11. Design-patterns to Recognize.....</i>	<i>43</i>
<i>Table 12. Form mental patterns of what to search for:.....</i>	<i>43</i>
<i>Table 13. Expanded search for illustration images.....</i>	<i>44</i>

Acknowledgments

I have many people and fortunate circumstances to acknowledge. It was the clear way that Christopher Alexander's pattern-language became discussed in the software community that first made it clear to me that I could use it too, which I greatly appreciate. It allowed me to translate the patterns of natural systems I found and wrote about in the 70's, when Alexander was doing his seminal work into this more communicable way of discussing them. I had a fine education in physics too, at a small college with a wonderful physics department, professors Peckham and Rohmer at St. Lawrence Univ. They encouraged my odd studies of how lab experiments always misbehaved. I found inspiration at the Univ. of Pennsylvania School of Design too, both from visionary faculty and the pervading presence of Lou Kahn's deep ways of thinking about the natural form. Of course, I am also indebted to being taught how to observe natural patterns from a very early age by my father Clement L. Henshaw, a professor of physics at Colgate. His idea of teaching was to show students where to find explanatory principles for themselves. I also owe thanks to a friend from high school, John A. Blackmore, who became a social scientist and I must credit with many of my key insights, as well as being a constant intellectual partner with a wonderful appetite for any subject we could think of talking about, through all the years.

More recently many indispensable sources of insight and guidance for my work on the project. Among them were the important contribution Christian Kohls made in reviewing the workshop version of *Mining Living Quality*. I of course owe a debt of gratitude to those who welcomed me into the *pattern-language* community, to the PURPLSOC and PLoP organizations, and the friend that introduced me to them, Helene Finidori, who I met through long discussions on lobbying the UN for taking a "commons approach" for making our home on earth. My prior years of experience attending UN meetings for drafting the SDG's introduced me to numerous large and small organizations of fine thinkers, greatly expanding my exposure to other ways and directions of thinking.

Jessie Henshaw

References:

Author's

- Publication Page: <https://www.synapse9.com/jlhpub.htm>

- Active Research Journal: <https://www.synapse9.com/signals>

Mining Living Quality

Alexander, C. (1965). A city is not a Tree. Architectural Forum, Vol 122, No 1, April 1965, pp 58-62 (Part I), Vol 122, No 2, May 1965, pp 58-62 (Part II): online - in the Pattern-language archive at:
<http://www.patternlanguage.com/archives/alexander1.htm>

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

Alexander, C. , (1979). The Timeless Way of Building. New York: Oxford University Press.

Alexander, C., Neis, H., Anninou, A., King, I., (1987). A New Theory of Urban Design. Oxford Univ. Press.

Alexander, C. (2001-6). The Nature of Order, Books 1-4. Center for Environmental Structure, Berkeley, California, USA. Book, 1. Center for Environmental Structure

Alexander, C. (2002). The Nature of Order: An Essay on the Art of Building and the Nature of the Universe. The Center for Environmental Structure.

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

Andrea De Lucia, Vincenzo Deufemia, Carmine Gravino *, Michele Risi (2009). Design-pattern recovery through visual language parsing and source code analysis. The Journal of Systems and Software 82 2009 1177–1193

Ashby, W.R. (1958). Requisite Variety and its implications for the control of complex systems, Cybernetica (Namur) Vol 1, No 2, 1958. online - <http://pespmc1.vub.ac.be/Books/AshbyReqVar.pdf>

Bauer, R., & Baumgartner, P. (2010). The potential of Christopher Alexander's theory and practice of wholeness: clues for developing an educational taxonomy. In Proceedings of the 15th European Conference on Pattern-languages of Programs (p. 12). ACM.

- De Lucia, A., Deufemia, V., Gravino, C., & Risi, M. (2009). Design-pattern recovery through visual language parsing and source code analysis. *Journal of Systems and Software*, 82(7), 1177-1193.
- Finidori, H. (2014) Collective Intelligence Is a Commons that Needs Protection and a Dedicated Language. *Spanda*, V.2, 79-89.
- Finidori, H., et. al (2015). The PLAST Project: Pattern-languages For Systemic Transformation. *Spanda*. VI.1, 205-218
- Goldstein, J. (1999). Emergence as a Construct: History and Issues. *Emergence: Complexity and Organization*, 1(1) ISSN: 1521-3250 eISSN: 1532-7000. online - <https://journal.emergentpublications.com/article/vol1-iss1-1-3-ac/>
- Goodwin, B. (1994). *How the Leopard Changed It is Spots*. Princeton Univ Press edition, 2001
- Hanmer, R, Mirakhorli, R, (2014). Mining New Patterns by Learning from the Trenches, PLoP proceedings 2014. online - http://www.hillside.net/plop/2014/papers/Pattern_Language_and_Mining/hanmer_2.pdf
- Harasawa, K, Miyazaki, N, Sakuraba, R, Iba, R, (2014). The Nature Of Pattern Illustrating: The Theory And The Process Of Pattern Illustrating, PLoP 2014 proceedings. online - http://www.hillside.net/plop/2014/papers/Social_Related/harasawa_2.pdf
- Henshaw, P. (1979). An unhidden Pattern of Events. Republished 2014 in An Open Source Pattern-language H. Finidori (ed). From the self-published book of the same name, Denver 1979. online - <http://debategraph.org/Details.aspx?nid=360233>
- Henshaw, J. (2015). Guiding Patterns of Natural Design: Principle Elements. PURPLSOC 2015, July 3rd to 5th, 2015, Krems, Austria; proceedings. Online draft http://synapse9.com/pub/2015_PURPLSOC-JLHfinalpub.pdf
- Iba, T., Isaku, K., (2012). A Pattern-language for Pattern Mining on a Holistic Approach, PLoP 2012, proceedings. online - <http://www.hillside.net/plop/2012/papers/Writing%20Group/Holistic%20Pattern-Mining%20Patterns.pdf>
- Jacobs, J., (1961). *The Life and Death of Great American Cities*. Vintage Books, ISBN ?
- Jacobs, J., (1970). *The Economy of Cities*. Vintage Books, New York, ISBN ?
- Jacobs, J., (2000). *The Nature of Economies*. Vintage Books, ISBN 0-375-70243-1
- Kohls, C. (2014). The theories of design-patterns and their practical implications exemplified for e-learning patterns. Dissertation, for the Faculty of Mathematics and Geography, Catholic University of Eichstätt-Ingolstadt. - <https://pdfs.semanticscholar.org/5f6f/2da27929b7f1c03142a5b4b98d654ea8551b.pdf>
- Mirakhorli, M., Shin, Y., Cleland-Huang, J., Cinar, M., (2012) A tactic-centric approach for automating traceability of quality concerns. Proceedings of the

2012 International Conference on Software Engineering, 639-649, 2012, IEEE Press.

- 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>
- Rising, L. (1998). The patterns handbook: techniques, strategies, and applications (Vol. 13). Cambridge University Press.
- Schuler, D., (2008). Liberating Voices: A Pattern-language for Communication Revolution. Cambridge, MA: MIT Press.
- Seamon, D., (2007). Christopher Alexander and a Phenomenology of Wholeness. Environmental Design Research Association (EDRA) proceedings, Sacramento, CA, May 2007. - <http://www.arch.ksu.edu/seamon/Alexander%20as%20phenomenology%20of%20wholeness%20dec%2008.pdf>
- Solé, R., Goodwin, B. (2000). Signs of Life. Basic Books, New York.
- 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>

