Guiding Patterns of Naturally Occurring Design: Mining *Living quality*

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Abstract:

The "*living quality*" provided by well-made things seems to combine the experience of fully satisfying services for both users and providers, and the way they spread delight and a feeling of *wholeness* in the world around them. The "*simplifying ideals*" of their *design pattern*s can be described as "*unifying responses*" to the "*forces*" found in their recurring situations, defining the essentials of organizational solutions having "*emergent properties*" not achievable other ways. The interface between such designs and the worlds of their users and providers needs to be created and made whole with each application. It's enhancing the *living quality* of those connections that is the focus here, considering designs as bridges exchanging services between the worlds of served and providing communities. Methods are offered for finding guiding examples of the elegant ways natural designs make their connections whole, exposing how they contribute *living quality* and *fitness* for their worlds, and may suggest ways to improve direct performance too.

A formal *design pattern* is discussed: "Mining Connections for *Living Quality*", using *pattern* papers from last year's PLoP meetings for examples to illustrate. That is followed by sections on general theory, methodology and the large repositories of natural patterns available to learn from. The paper follows one for PURPLSOC 2015 (Henshaw 2015) that introduced the study of guiding patterns of naturally occurring design for improving our ability to recognize and work with the *design patterns* of nature in general.

Categories and Subject Descriptors: H.0 [Natural World Factors] H.5.2 [Information Interfaces and Presentation]: User Interfaces - Evaluation/methodology, *Theory and methods*, *Natural language* I.2 [Artificial Intelligence] I.2.1 Applications and Expert Systems - Natural language interfaces I.2.7 Natural Language Processing; *Language parsing and* understanding I.5 [Pattern Recognition] I.5.0 General I.5.2 Design Methodology - *Pattern analysis*

General Terms: mining living quality, pattern language, natural patterns, pattern search, pattern templates, liveliness

1. Introduction

A *pattern language* approach to discussing complex designs doesn't use technical language as much as a very careful use of natural language. So the meanings and usage are those that accumulated from human experience over a long period, and should be quite familiar. What would be more unfamiliar here is using natural language to discuss the experiences the meanings of our familiar words come from, how we interacted with the naturally occurring designs that we though 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 "backwards", but it's highly informative and very useful for discovering the designs of nature that seem important to us, and how they're arranged. It's 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.

It turns out to help a lot to think about the familiar contexts and experiences our words seem to refer to as the source of their meaning, like "box" refers to what we know about and do with boxes, and "trouble" refers to strains on complex relationships that matter to us. Much of the complexity of those relationships can be found in the varied usage of those words and the circumstances they refer to. You tend to find the particularity of our word meanings comes directly from the particularity of the natural designs and relationships our words are responses to. It's then a way to find new examples of the naturally occurring designs that may be referred to, and for learning more about them.

When reading long papers, especially on unfamiliar subjects, it's good to pause and think over the sentences just read, and your own new thinking. New subjects demand so much concentration one needs to pause at times, to develop your own thinking and absorb what you want. If some kind of natural process of "exchange" or a kind of "resilience" is discussed, one can create memorable detail just by recalling when and where you've had related experiences. It helps particularly if you can recall or make up little stories or sketches, perhaps to illustrate the "rule", or sometimes the "exceptions" or trying fanciful ways of over or under playing them, testing out what the they do.

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' being relied on. Those ultimately define the 'circumstance' being discussed. 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 own imagination. Sometimes they are sharply defined by discovering the natural boundary of the system you find yourself 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 affirms the trusts needed for business agreements sometimes, but a

small change of manner or circumstance could alter the meaning greatly. What if you went to a boat house 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 your thanks. You'd feel lost and confused, forced to question literally everything about the day perhaps, with something so "*out of place*". It helps you see the very complex design a normal business greeting is part of. It exposes how the *living qualities* of the transaction are so important, both very functional as well as nice. You might be more conscious of provide for them all in some circumstances and see how to be more casual in skipping some in others. Its 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 turned into a general method for studying the design and behavior of individual systems of all kinds. It also turned out now to be a way of recognizing natural designs that fits very well with the practice of *pattern language* 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"[2]

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. [3]

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[2] phrase "describing the invariant qualities of all those solutions" from Tidwell 1999

[3] *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 own 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's 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's 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's unusual in a research paper to present the user practice first, with the theory and resources for it to follow. It's done to introduce the parts likely to be most familiar to readers first, to help with seeing what the new method if for before presenting details. It also responds to the general finding that "practice and theory are much more intertwined than we often realize"[4]. Hopefully it will make the theory more understandable, as it's only in thinking about the practice you begin to see the special difficulties and opportunities you need a theory for. 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 stories to connect theory with experience and thinking of applications while reading does mean reading more slowly. It also results having more of one's own ideas as starting points to going further, too. Thoughtful readings of long papers can't 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 own 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 illustrated in Fig 1. The idea of mining its connections to enhance the *living quality* it offers can be thought of as just making better connections. Any design receives services one place and delivers them in others, while

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[4] From PhD thesis of Christian Kohls

being responsive to its environment too. The *living quality* can be thought of as coming from its quality services, responding to and fulfilling the "whole need" being served.
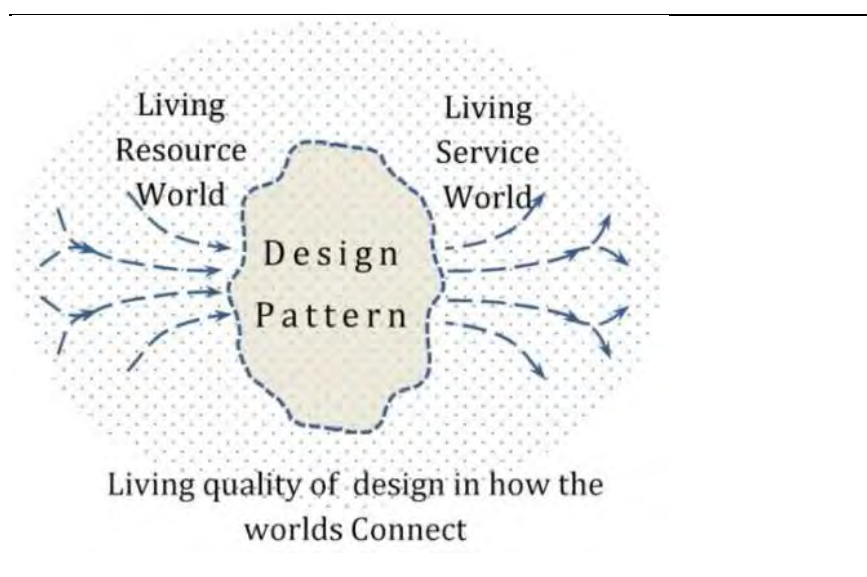
Designs embedded in a living world

Figure 1. Flowing connection

I often think of little examples for illustrating conceptual principles like these. If I think of "whole need" I might imagine a traveler on a wet night entering a restaurant, thinking about their desire to get comfortable and what's needed for that. Is or isn't there a place to put wet clothes, or 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 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's needed what's missing.

• You might think of a few designs you often use and identify the "service user and provider cultures" they have the purpose of connecting. 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 <u>all</u> the meanings of that, as "a welcoming place" 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. In addition 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 really needs rich experience in noticing the complexity of the needs their designs serve. They need ways, in as sense, to "look under the rocks" and see how naturally occurring designs interweave complex networks of services for living things to thrive. Finding a *pattern* in either served or serving resources not thriving can be a sign of something altogether missing from the design, or at the time when it's needed. Both of those kinds of observations really require developing a practice of noticing the *pattern*s 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 pays off in smoothing the flow of every other group too. It helps to stretch your imagination and think of examples.

The general technique discussed most in this paper uses a special technique for searching one's own experience to learn from it in a new way, a technique I call *pattern search*. To learn more about the quality of a particular service to be provided you can find diverse examples to learn from by first forming a more general idea of it, and use that more general idea as a *pattern* idea to use in searching for varied real examples to learn from.

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 more general 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 provided for, 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 your mind to what the whole service really is, in this case to provide "a good meeting first" for achieving critical functions of the "docking". That's the general idea. Using *pattern search* to survey recurrent general *patterns* of design found in living environments also gives you a very rich contextual exposure and understanding. 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 close family of them. Then searching your experience for where varied examples might be found becomes fairly easy, and raises related families of designs letting you expand your 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 can't start without a start-up plan. The same *pattern* of "accumulative design" is seen in how relationships of all kinds can't really begin without steps of introduction, or how technologies can't

develop without their initial ingenious small innovations. Every beginning generally needs a *starting pattern*. That's a general *pattern* of natural design that pervades intentional designs too. They can't develop without having a way to start. Generally a start-up *pattern* comes about by a smaller scale process, and then its replication at first accelerates to eventually follow its natural course to a limit.

Table 1.   Mining Connections for *Living Quality*

Name: Mining *Living Quality*	Domain: Joining intentional and natural design patterns
Image: Living Quality	Context: • Refining a proposed or working *pattern* Forces: • 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 re solving primary ones • The ideals of qualitative design to bring living quality to serve the world being worked in • The hidden conflicts and unserved communities not noticed Resources: • The design *pattern* and its world of connections, • A designer's connections and life awareness • Natural *pattern* repositories to explore for creative ways of offering living qualities
Concept: • Designs are a bridge between living things serve and served by, thriving in the *living quality* found.	Solution: • 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 *pattern* repositories provides living examples to study for features on which living environments thrive.

Table 1a.   Supplemental values

| Theory:
 • Expanding the possibilities in the near environment adds to its fertility and resilience, serving the whole. | Stages:
 • We review the design and the places its connections can be explored, 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.
 Other useful results:

 • 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 |

Table 2. Template for Describign Purposeful Design Patterns

Name	Context	Forces
Image	Problem	
	Solution	
Subject	Actions	Results

Table 3. Template for Describing Natural Design Patterns

Name type	Problem Boundaries & Scales	Forces Resilience & Animation
Image	Context – Arrangements of : • Centers • Roles & • Stages & • Movements	
Simplifying Relationships	Object Domain & engagement	Solution Learning process
Links	Results, Tracking, & Adjustments Anticipated Open questions	

• For a community of local businesses that develop in a certain section of a town, the start-up is often some notable "pioneer", who "broke ground" creating the model that others created variations on. You may have examples in your own town, of a cluster of businesses, like a large and small industry collects. Try to recall or imagine the starting innovative combination of services that found its home and spread that way, what defines its boundaries and culture.

For mining *living quality* we only need these basic ways of recognizing *patterns* of naturally occurring design. We just bring to mind what we already know, much of it tacit knowledge in our own common understanding 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's a quality that few things can hide, and a deep indicator of the qualities and resilience of the design in the process of maturing.

The *pattern* writing template of Table 1 is adapted from a more standard form of *pattern* template (Table 2.) and an extended form (Table 3.) developed for writing *patterns* of naturally occurring designs that would have added complexity. Those are from Slide 8[5] 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 evidently persist from its origins. We easily recognize that in people born with their original characters that are fulfilled as they grow, and with social movements that retain their originating patterns as they grow and mature. It's evident in all living organisms too. We

also see it in emerging technologies, where more complete ways of responding to the same concept of what is to be served are what innovations develop. It applies to the style of products and services of companies, and to the character of both art movements and performance groups, that what becomes their unique "brand" was a pattern there from the beginning. It's also illusive, such as when knowing all people to be individually unique and insightful, our assumptions about them may not be, causing confusion often enough. It's one of the great reasons naturally occurring designs can very much surprise us, their uniqueness hidden from our view till it develops.

Degrees of maturity are good to include in the design narratives one uses to explore the living qualities of a design as for projects and skills, reflecting a stage of achieving the intended *pattern* ideal and finding the next stage to work on. In many environments one may be combining things that are young, flexible and immature with those that are aging, less flexible and experienced. It helps to think about how they'd "talk" (if at all) and so exposing important details of what will function smoothly. For real services to work smoothly designs need enough tolerance and variety to satisfy and serve diverse needs and capabilities, mixing "unbalanced forces" and "discovered opportunities", using the surplus for needed resilience and comforts.

A simple example would be to compare the habits of a young struggling 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. 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 artful practices the opportunity. If your software has a mix of resources of unmatched quality like that it might help you think about how

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[5] http:// synapse9.com/_PLref/2015_PURPLSOC-Slides/2015_PURPLSOC-jlh-Slide-08.jpg

to 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 using PloP 2014 studies

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. It seems to illustrate several important things about *pattern language* as well as about the intent of mining *living quality*, by exploring how it works for its service user and provider connections. There are two examples discussed. One is a way to suggest evocative illustrations for a pattern, that might be enriched by asking what the experience of the pattern to be illustrated would mean to those serving and using it. The other is a way of collecting existing software scheduling patterns to adapt, that looking at naturally occurring equivalents might show ways to improve, such as to understand "scheduling" by considering the pattern differences of great restaurants and dead ones.

This approach also illustrates how discovering new perspectives of a whole can add dimensions to it. It's 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, it adds new dimensions to both how they are thought of and to what they 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 only thinking of readers already familiar with the subject. One then needs to use imagination in combining the bare descriptions of circumstances and suggestive names used to form an image of 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 debates most would not understand becomes a barrier.

It's 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 don't correspond to the English language meanings for the same terms. One case was the use of "*coherence*" (as a technical term) to mean "appropriateness" (the natural meaning intended). In describing *patterns* of design a mix-up on evocative word

meanings like that could be highly consequential. So it appears that any research paper needs discussions that any informed lay reader can understand, because pattern language in inherently intended as a common language not just another silo for specialties. That would then need to rely on a rich use of natural language and the deeply rooted common meanings of words. Sometimes it helps to show technical terms in quotes or italics, to distinguish them.

3.1.   For Pattern Illustrating

3.1.1 Center words and Working words

Harasawa et. all. (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 all. 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 all.

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 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", the way of being more than the sum of the parts.

Table 4. Working Words (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. all., the group first collected and categorized types of *center words* from the whole collection of 108 *design pattern*s 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. Groups of Center words for Composition, evoking:

• Forms of Power	• Patterns of Arrangement
• Directions of Power	• Forms of Status
• Movements of Power	• Periods of Time

Table 6.   Groups of Center words for Elements, evoking:

• What	• Feelings / Temperature
• Properties of What	• Atmosphere
• Actions	• Properties that evoke feelings or atmosphere
• Properties of Actions	

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

Table 7.   **Steps of Pattern Illustration**

1. Finding Center words - in the descriptions having strong meaning

2. Creating the Living Structure of the Pattern through the Center words
   - studying its center words to envision the living structure as a whole

3. Drawing the Pattern Illustration - to express that vision

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 were illustrated as a, b, c & d and the final image shown as "e" below (Fig 2, 3), an enriched image of being immersed in a language shower. The basic steps taken would be about the same, actually, for mining images with living qualities from naturally occurring designs, with the exception being that the latter would be more focused in searching in the living connections of the pattern with its environment.
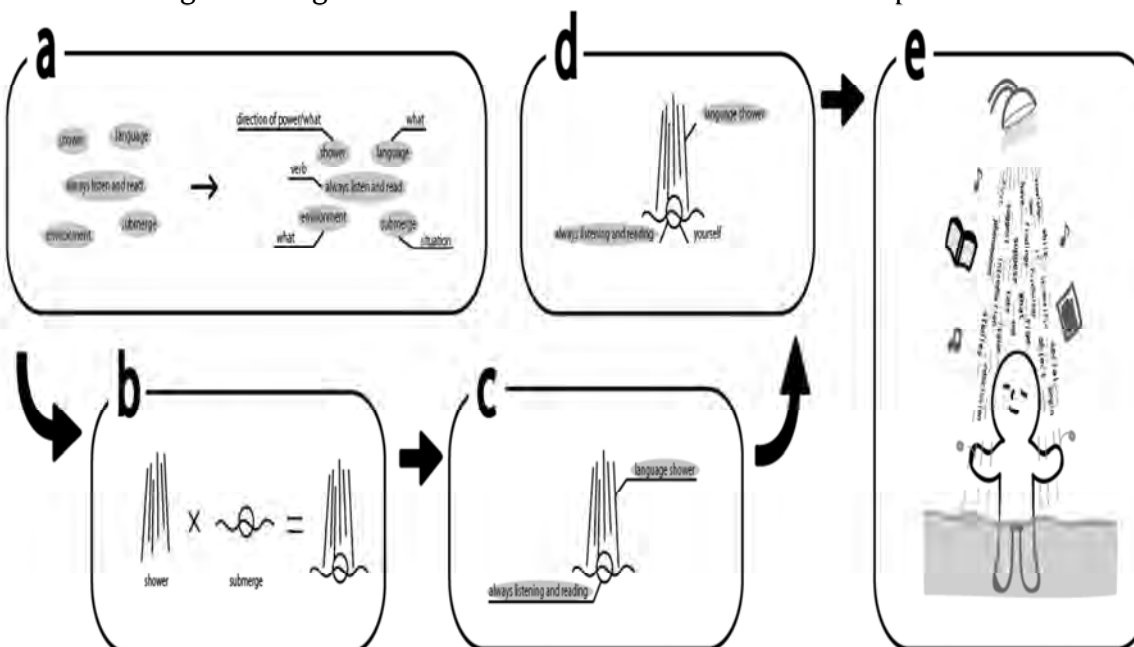

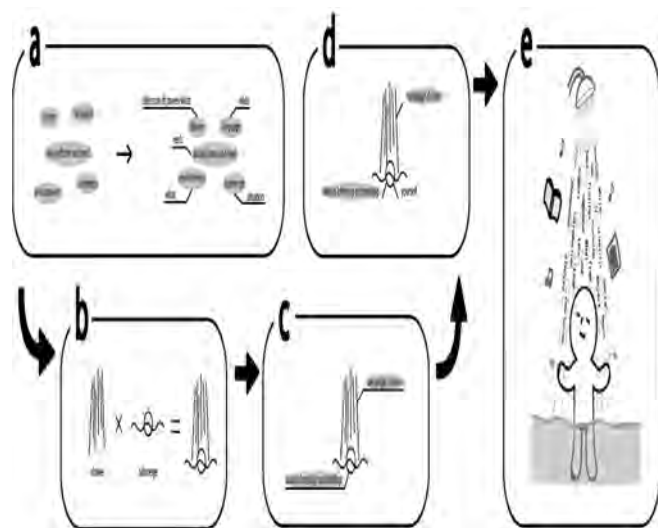Figure 2.   Steps of Composing the "Living structure" and Illustration

Figure 3.   The selected illustration "Language Shower"

3.1.2 Discussion

To enrich the "Language Shower" *pattern* we can explore how it serves the writers and users of the *pattern*, to study the *living quality* each enjoys from it. What the team used here were the *center words* the group used in the text describing it. We might ask; Are there other sources for suggesting the meaning of the *pattern* to the users and creators of it, to enjoy being associated with? One of the better options is immediately suggested by then asking; What will the *pattern* really mean to its users that directly conveys to them what it is for?   In this case the pattern gives language learners first an added struggle with the language and then the delight and pleasure fluency, that both come with learning by immersion. That's a classic before and after image that might provoke lots of interesting experiences to illustrate.

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, the symbol of "liveliness" shown in Fig 4. In developing the symbol I used to represent *living quality* I did not explicitly extract evocative *center words* from the completed text of Table 1. My approach was actually sort of the reverse.

Life emerging

Figure 4.   Liveliness

Half way through describing the pattern I searched for a symbol to evoke the intention of the pattern, and arrived at Figure 1. I was looking for guidance on how to write about the pattern, needing to have a suggestion for wht it should feel like, as a symbol of what I was writing about to help complete the text. First I did an online image search, using all the descriptive terms I could think of. Not finding it I first started drawing diagrams showing of *design patterns* as connecting their serving and served connections, finally coming up with what became Figure 1, illustrating the "*working words*".

That was very good, but it had little feeling of *living quality.* It was too much like a *working diagram*, illustrating the *working words* important for making the pattern work, not at all suggestive of what the pattern was for. I found myself thinking of situations closer and closer to what happens at the interfaces between designs and the things they serve and are served by, having images of what it feels like to find yourself in a job that wakes you up and lets you thrive, and things like that.

Providing and using *patterns* of design and services that contribute *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's 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's 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 I noticed a group of discarded versions at the side of my drawing screen, arranged by accident where I pushing aside my unused attempts. It was quite close to the version seen in Figure 5. It might not be the final one, but captures part of the idea of *living quality,* represented as "liveliness", as "little motions coming to life".

That happy accident also brought out the similarity of my process with that of Harasawa et. all., 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 is done.

One other general observation, applying to any kind of search, is that testing multiple objectives and ways of searching may be valuable. Until you find what you want you could possibly 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 Figure 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
"by Learning from the Trenches"

Several techniques for mining software *design pattern*s from completed programs were explored by Hanmer & Mirakhorli (2014). My own 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 sometimes leaves me little to go on. For example, they don't actually describe their strategies in any conceptual way a generally informed reader might understand. They only state what they worked on and what it produced, though with great care and using 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" methods of search. When you're searching environments that is often the only way to define what boundaries you are searching. 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 whole patterns. As they didn't really discuss how the methods work, the effort here to suggest how they could draw out more *living quality* in the process becomes "Pattern Writing Archeology" it seems.

Here we are looking for a response to the whole method pieced together from fragments of words about collected separate parts. Fortunately natural systems are indeed very often found

to have organization of that kind, where every part has features particular to the whole, similar to how any of an individual person's signatures are recognizable, like the ineffable qualities of a neighborhood or culture that are recognizable even if taken 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 it were, as evidence of effort to use terminology that closely fits the intent.

- For new subjects we have to guess what they're 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 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.

There's also the possibility that, though natural systems don't have "software", of course, software is often mimicking designs from nature that one could learn more from. Learning to identify and study 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's 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 organic forms of nature are extraordinarily different in kind, if we can recognize how we can still speak of them as exemplifying the same ideals, we can study them as relating to the same *pattern*.

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" of tasks one can study too, getting things to show up when and where they are needed, and possible to recognize as forms of ideal *patterns*. Natural *patterns* of

"scheduling" can seem mysterious in how successful such 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 and having life in "populations" to maintain and evolve species, clearly result in tremendous resilience for the design of life, we are only beginning to appreciate. The continuity of systems over time allowed is in the billions of years, actually. It displays productive and efficient design somehow, way 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.

• This method of "*pattern search*" takes a little practice, but once you get the idea it's quite similar to the kind of fun "free association" people love to do, except that you keep track of what you are making associations for. You might try covering the right hand side of an article or story you have not read yet, and see what generalities you can guess would be variations on the author's real meaning, and then look to see.

Designs for scheduling material deliveries in nature include simply scattering things, with no recordkeeping at all, creating great repositories of "free stuff". They include the numerous kinds of "mediums of exchange", like "markets", "resource pools" and "circulatory systems" like the blood stream. They occur on so many scales they're hard to categorize, except as seeming to fill all the spaces in-between the centers of dense complexity of design and organization we find. They're marvelous at matching the diverse byproducts 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 are all just tossed out in the open with no end purpose attached, and become tremendously reliable resources and means of communication, for whatever user comes along to make something with them. What one can gather from it seems to include that whether a *pattern* for providing services really does, it will always come down to asking what others will find to do with it.

The application Hammer & Mirakhorli present leaves us mostly to speculate on those issues, describing neither how the types of scheduling *patterns* were found or condensed. It may be clear to trained programmers what the coding maps for them mean, but it's not discussed. To interpret them one still needs to generalize the *patterns* they represent, as the basic step for using "*pattern search*" to associate and compare them with related *patterns* found elsewhere. Here it the suggestive words the authors chose that can be used to search our experience for related examples in nature, if we find successful ways to generalize the *pattern* ideals represented. We seem to have only the names of the eight types of problem types and associated names of the *patterns* types which the study found for them (Table 5.)

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. There was no discussion of why those names were chosen, which would have helped. The problems identified were generally named using *working words*, as discussed above, and the *patterns* 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 given, to intuit a *pattern* general enough to be used for searching related examples from experience. So we try to imagine how the names imply the pattern's roles in its environment, to have some image on which to search for related ways of coordinating services in nature.

3.2.3 Software Archeology.

Table 8.

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 can't find out who they are, or they've moved on and aren't interested in talking about the old project or they don't have the time to really help you out. "Crowdsourcing to extract and document design patterns" could be done -- to get a group of people to jointly help
• You have access to the source code, something that you don't always have.
• The documentation about how it was implemented, the design documentation, is unavailable. It might be non-existent. Sometimes its available but you aren't quite sure if you can believe it, or it's for a

previous version of the artifact.

• You aren't undergoing the effort to fix a single, concrete fault. Your 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's 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, Struture 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 really determine whether the pattern is useful. This is another place where "Crowdsourcing to extract and document design patterns" can come in useful. [Hanmer & Mirakhorli (2014)]

The method for Software Archeology is described in Table 8. *, as* having used a combination of manual and automated code searching methods, discussed for use on a selected "large software artifact". The results shown in Table 9, though, were found by a prior study, apparently the study from which the *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 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."

The effort appears to have been as wide a study as they were able to do, bounded by natural resources and access to them, and so defined as 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 don't even report the number of cases of each pattern type.

The names for the six kinds of software scheduling problems and *patterns* recognized for them are shown in Table 9. In the paper a figure with their conceptual software process flow diagrams is shown, here as Fig 5. You can see that the names of both the problems and *patterns* refer to diverse forms of design; with two having differing *patterns* variations at differing scales

simple but distinctly differing organization, seeming arranged as ideals. All in all the results seem like a normal variety of distinct characteristic natural pattern types, such as one might find in families of many kinds of things. You might get about the same kind of group of characteristically different forms of "stairs" or "doors", for example.

What's missing that one also finds in most natural patterns is discussion of the types of designs going uncounted. Those are hard to see as they don't as easily fall into groups exemplifying 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 described as the "unpatterned" designs and the marvelous "one of a kind" patterns that you also find common enough in virtually all families of things too.

Still, the six types of characteristic software scheduling *patterns* leave a clear impression as being found and named in a way suggesting that they 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 characteristic naturally occurring *patterns* to learn from. Interpreting the *pattern* names as *center words,* thinking of their root meanings and associations with other circumstances, one can use the *patterns* they suggest to find examples of others, using the *pattern search* technique.

———————

To discuss just one example, consider scheduling *patterns* 6a and 6b:

6a - 'Multiple task' 'One-step' called *Bridge*

6b - 'Multiple task' 'Multi-step' called *Adapter*

system of the restaurant. It bridges between talking to a waiter and telling them what you want. It's 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			
	A.	a.	B.
	Problem	Context	Pattern Name
1	Many tasks		• Flyweight
2	High resource demand		• Proxy
3	Stateful tasks		• Memento
4a	Task monitoring	Simple	• Observer
4b		Complex	• Composite
5	Remote task		• Proxy
6a	Multi-task	One-step	• Bridge
6b		Multi-step	• Adapter

Table 9. Software Patterns Found

J.H. Suggested natural pattern types		
	C.	D.
	Naturally Occurring Designs	Relating Property
1	• Sweeper, Dealing, Dispatch, Batching	• Multiple or Frequent Small Tasks
2	• Producer, Manager, big team	• Complexly Organized and Costly Tasks
3	• Cooking, Education, Politics	• Changing States and Forms
4a	• Customs Check, Host, Bouncer	• Grading, Categorizing
4b	• Impact Reporting, Rehab, Assessment	• Digestion, Accounting
5	• Drone, Outsourced, Market, Insurance, Expert	• Reactive & Discovered Search / Access
6a	• Restaurant Menu, EBay, Market picks, Acquaintance	• Complex Choices
6b	• Sous-Chef/Waiter Triage, Fractioning	• Complex Performance

Table 10. Natural Patterns Suggested

(a) Many Tasks: Flyweight

(b) High Resource Demand: Proxy

(c) Stateful tasks: Memento

(d) Task Monitoring: Observer

(e) Hierarchy of Monitors: Composite

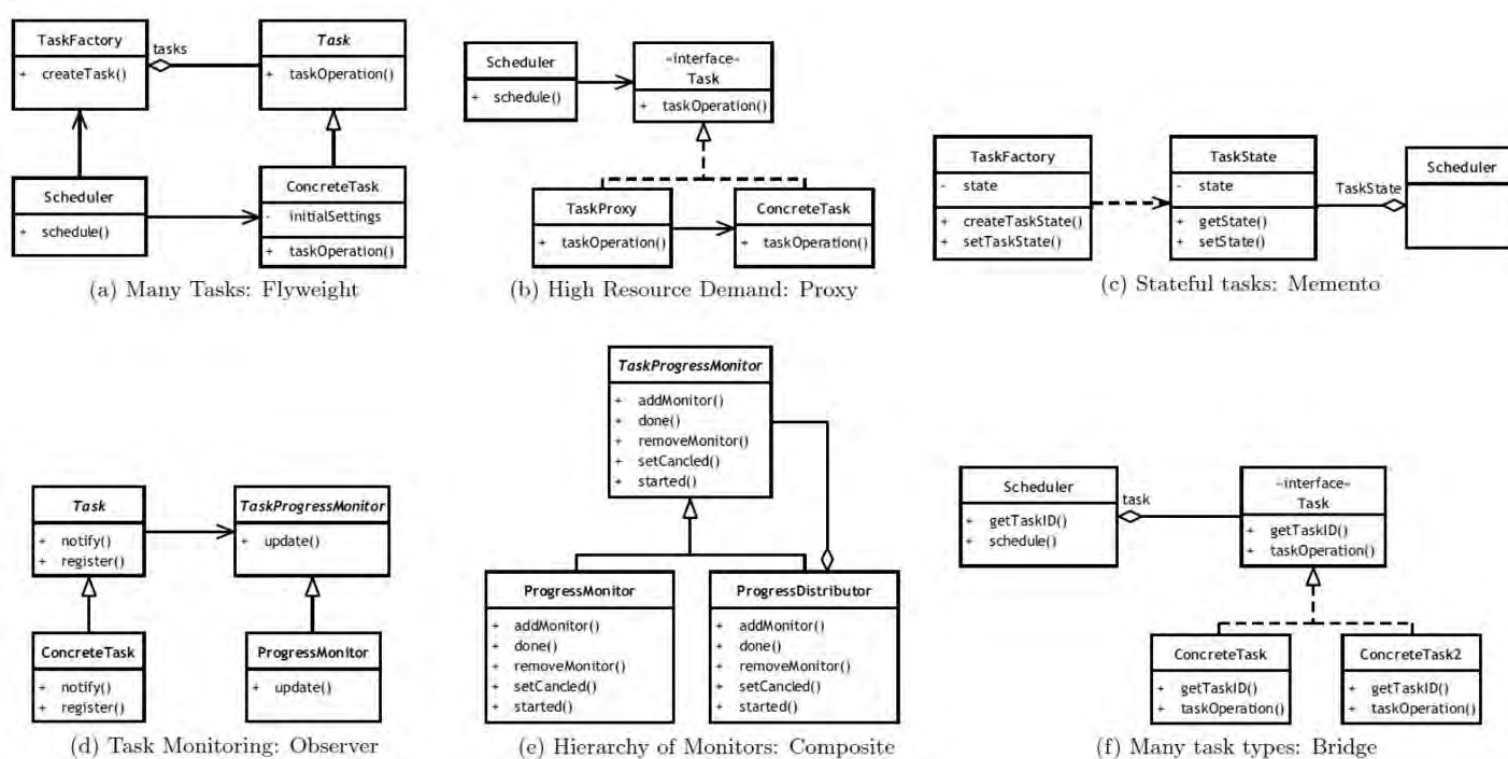(f) Many task types: Bridge

Figure 5. Patterns to address variability points in Scheduling Tactic

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're also often not ready to order at first. So they often glance at the

feel at the time, needing to see what they are in the mood for. It also often takes time just to adjust to finally getting to sit down and taking one's mind off getting there.

You might also need things from the pocket of a coat you checked, or to change tables so you'd see when friends arrive

in" that one generally finds between any separate activities. Those steps for getting settled always make a big difference, too, both in satisfying the activity before and the one after. In this case they lead to the main *bridge* of understanding what's on the menu, usually with the waiter's help, and choosing what to order.

• Computer users need to settle-in with the information design of menu pages. Would they like a note pad, or to have a history of their prior choices to review? Should main menus areas be designed as "user behavior *patterns*", and be better understood if hovering over their expressive titles brought up explanatory *working word* descriptions? Would the links for those behavior *patterns* be better shown on drop down menus, having both *center word* names (saying what they are for), and *working word* phrases (saying what they do)? Might different users prefer different "skins", or have such menus sorted by workgroup indicating frequency of use?

It is not only for "*bridge*" *patterns*, but really for all *patterns* for services that begin and end, that the service user and provider parts need for "*settling-in*" to the newly begun or ended relationships. You may have first noticed that going to restaurants, but it applies everywhere, the need to consider the living qualities of letting the users and servers get settled when changing 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're 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's 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's 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 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 'comity' of the room, and the likelihood of guests becoming regular customers.

3.3. Learning between program and performance

It's possible that to a diner the scheduling task for a restaurant is a simple exchange of money for a checklist of food items. That's all you really see. It's in how it's done that the living qualities of its operation for both its service user and provider partners 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's 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 a popular food carts too. It's a kind of *living quality* of satisfying and unified service that is both common enough and rare at the same time. It's seen and experienced often enough as something that may pervade some locally thriving culture or person "having it all together", as if that quality is flowing along all its chains of connections inside and out. We talk about it as "sustainability" sometimes, and of its great importance, I think also what Alexander talked about as "the quality without a name" QWAN.

As for writing down its *patterns* though, we don't really know how yet. It seems to come from inside the things that have it. All it seems we can do is point to it as something to learn about, and to use pattern language to discuss some and find living examples. That might be enough. The living qualities of responsiveness throughout a design are found in our experiences as the lasting character of good friendship, great families and timeless moments in the history of great movements, great businesses and great cultures too. 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. So perhaps understanding our own real roles in such accomplishments is something else pattern language can help with.

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 naturally occurring designs of nature. Studying what we can control, as opposed to

living system that behave by themselves, has been generally much more profitable. So throughout history, really, science has intensely studied just one side of life. Others were neglected. By focusing on fixed systems and relationships and rules of "cause and effect", we neglected learning about lively and changing systems and relationships visible throughout nature too. So we have a considerable language deficit for discussing "non-steady" types of change seen in kinds of emerging and lively organization and transformation, so central to systems of life. They don't follow fixed rules but creative patterns, so the scientific method itself becomes undefined for studying them. It is part of why scientific models and predictions seem "lifeless", that science didn't find a way to studying lively behaviors.

The first step to learning about literally anything, of course, is to identify the subject. That's what *pattern language* is primarily designed to let people do, identify complex patterns of relationships as recognizable objects of design and behavior. In common usage they are called "*centers*" or "*objects*" or "*designs*", sometimes rigorously identified as physical systems of self-organization, and sometimes more loosely as recognizable patterns of association people are trying to understand. It's still science in the sense that you are looking for verifiable answers about commonly identifiable subjects, but you're asking quite different questions.

The general method is to collect lists of observations from many points of view, on everything in a situation that is or needs to be responded to, and then identify *simplifying ideals* of design found as its "*patterns*". Each profession tends to develop its own standards and so as it spreads people also need to coordinate standards. The benefit is it makes it possible for groups of people to identify and discuss their issues regarding commonly recognized situations, identified by a jointly authored holistic *pattern*. It leads to finding simplifying ways of responding to the whole spectrum of *forces* identified, and exhibit qualities of *fitness* in its environments. So all-in-all it organizes more of a conversation with nature than analysis and control. It comes from Christopher Alexander having an insight into how to write down and make more explicit the kind of design thinking architects have done all along, making it much more intentional.

It's a method that would help both the professions and our culture learn to recognize the kinds of organization causing lively change, and how to respond. We'd certainly still pay attention to using fixed rules, where they apply, and that it is generally not for the organizational problems with lively change. Then it's often more a matter of discovering what's missing from the organization and relieving that need. So in that sense it's not "forcing" but "helping" the problematic design recover. Learning to recognize patterns of organization as both the solution and problem for many concerns uses information in a different way, in a "descriptive" rather than a "proscriptive" way. It's using information to refer to how things work and

associate it with what they mean together. It's learning from nature rather than making models representing nature as following a theory.

What most distinguishes information models from natural forms of organization is that information models need defined terms and fixed rules, to be self-consistent. As a result they are also self-sufficient, and don't have environments. Natural forms of organization differ in that they emerge directly from their environments. Each approach uses different kinds of information too. Information models rely on reducing nature into sorted categories that people define. Pattern language looks for information to direct our attention to how nature works, collecting data using the natural categories nature defines. That's why it can reflect the actual organization of the natural system rather than an invented one.

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 70's. 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 own 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 kinds of accumulating design memory in their surroundings in developing by themselves. It would appear my main breakthrough was noticing that what defined such natural systems was how they individually developed, by accumulating their complex designs in stages. That seemed to explain why they continued to reflect the patterns they originated from, not actually being information constructs at all, but accumulations of patterned design.

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 local 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 a universal *pattern* of accumulations, 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).

English doesn't really have a word for design without a "designer" to use when the self-organizing system 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 "learning" and "building of design". So having taken such a different direction I didn't really see how Alexander's main body of work was developing (Alexander 1965, 1977,

1987, 2001-6.) until long after it was adapted for software development (Rising 1998, Tidwell 1999). It was when my work turned more toward education and social issues finding educators and theorists contributing to PURPLSOC working toward developing *pattern language* as a general science, that I noticed the match (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 story tellers 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 didn't 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 natural designs as occurring naturally. She is quite eloquent in discussing the evolution of cities and their economics as 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 other places (Jacobs 1961, 1970, 2000).

Given so much in common with Alexander's view and pattern language, it is surprisingly 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. The both emerge from small creative origins that thrive and grow by working with others by a strongly history dependent creative process.

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's where, with luck and dedication, the creative emergence of new form occurs in the natural way for buildings, in the strongly opportunistic and history dependent stages of design within a community of designer's. What I think may be 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's much like what I arrived at too, that natural systems have active and stable parts, the active parts building their own capital infrastructure as stable parts, each shaping the other as they develop together.

4.3. 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's "unifying principle of design"
- actually is a unifying response to the *forces* identified,
  - for the real context concerned
- actually 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 a 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 need to ultimately serve,

- is there enough observation to 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 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
- take get 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 individual 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: Searching connecting lives and environments for unmet needs has lots of side benefits, such as filling in one's image of the pattern as a whole. Asking what else needs attention helps one avoid our subjective biases, exposing you to connecting natural circumstances external to the design, often not fitting one's usual assumptions, and expose unmet needs you might respond to. It also makes you aware of what might make things much worse. For example does a design create efficiencies for one thing and inconveniences for another, but not count them in the balance? Are there constituencies you might talk to better understand the needs of, need to look for to notice? You could certainly use up valuable time doing that, of course, but validating design assumptions as a double check things is usually good practice, looking for hidden risks a regular task. Being a "good neighbor" and generating "good will" are highly valued commodities too, just giving attention to connecting constituencies earns credit and adds living quality to the whole in itself.

Brightspots and Total Balance: Looking for "bringhtspots" might include discovering a market sectors unable to use the service due to special needs not in the plan or needed by the general market. Sometimes those take creativity to include, but come with greater profit from "understanding the system as how you make it work". Other kinds of bright spots might include graphics that brighten up the screen like Google does, spinning off parts of inventions others can use, letting promising young people take some risks, and other little "favors" in the spirit of making things whole. It's a bit like just adding a little "sunshine" where it might matter. Looking for "*total balance"* is of course having some way to look at the combined effect of the whole effort and the design's whole effect. There are lots of ways to do that, with all of them beginning from asking the question.

5. Great Pattern Repositories

The technique of *pattern search* can be used to explore the variety of *pattern repositories* to discover study and compare *patterns* of design of all kinds. We do it quite naturally, any time we "search for a word to use" for example. Here we discuss how we can focus and extend that natural thought process to following mental associations between recognizable patterns of design. The big step is simply to use our normal association of

situations in life with meanings to instead do the reverse, associate meanings with situations in life. That gives you examples to study to better understand the source of the meanings. Generally speaking when hearing the words like "apple" or "door" we could, but don't think of what it is about those subjects that gives them the meanings we get from them. Using pattern search helps you collect lots of related examples to help you do it.

Reversing your association of a meaning with a circumstance works to turn your attention to varied circumstances to better recognize what the meaning is in response to. To make it work for a particular pattern, like "your situation at work" or "your *pattern* for the project" you then first need to generalize it, maybe thinking of the related ideal you want to understand how to achieve. That's so it can lead you to a variety of related examples to learn from, just retraining your normal habit of looking for associations a little. You can do it with any cultural artifact or meaning you want to better understand, any word or gesture as well as any complex theme, object, or system. Just think of the natural situations it is a response to, and study the pattern of working relationships in that situation to understand it.

There are examples in the "Pattern Search" section 5.2 below and more discussion in the companion paper (Henshaw 2015). One can use the method to search any kind of pattern repository for varied natural occurrences of any meaningful *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 culture differences referring to the visible styles and manners of ethnic communities, but our "cultures" are much more than what's visible. They are really the entire package and containers for all our accumulated ways of knowing and living, what we rely on entirely to live as social beings, and of which we have deep intuitive understanding. It makes our cultures our greatest and most accessible deep reservoir of links to 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 a particularly deep and rich body of mostly "tacit knowledge" (known without thinking), and part of all our thoughts and doings. Searching our thoughts for the natural circumstances our conscious thoughts tap into and makes us more aware of what was hidden and unconscious knowledge. For various less accessible domains of the great pattern repository of culture we might need other methods, of course. Some we might know well but just never have thought of exploring this way.

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. It's expressed in both the tacit and conscious designs we create, our self-aware and spontaneous behaviors, our verbal and non-verbal manners and traditions, all as patterns of response to our experience of nature and each other. 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 your own patterns of searching it. As soon as we're born we start absorbing our family and neighborhood cultures, making our own versions of the million year old ways of knowing and living that every family, community and society passes on. Our own 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 own 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 own ways of living, its own *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 other examples of similar ones. There's the example you search with, and the way you follow some strategy in looking for related examples. For example, watching people and animals you see them visibly searching for how to satisfy their own needs, nearly all the time, repeatedly searching for one thing after another. Sometimes people or animals are seen visibly searching for things, either following a trail or looking for a trail, connecting strings of patterns as if following the scent of a pheromone trail, Figure 6. They may also be searching for parts to add to something being built, one part after another, or they may be exploring a territory to discover its variety. It's a tremendously versatile method of environmental learning.

A pattern in mind to search for

Figure 6. Pattern Search

 External observers would not see what is being searched for, or being searched with, though. The search path one observes as people or animals cast about to cover a domain can be a many different kinds and be informative. Then an observer may recognize the search pattern and guess what is being searched for. For example, it's hard to tell what a snail may be searching for, but you see their tentacles moving around often enough to suggest they are looking for something[6]. The way a search is being done shows a lot about what is being searched for, like

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[6] A snail has eyes on each tentacle, and looks around as its search pattern
http://www.molluscs.at/gastropoda/index.html?/gastropoda/morphology/tentacles.html

"metadata", and often productive to use for where to look more closely.

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.

The *pattern search* used by Harasawa et. all. (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 11.   Design Patterns to Know How to Search For
     (Doors to Key Natural Pattern Repositories)

1. Trails of *Patterns*   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

Table 12.   To search for things we first form a pattern in our minds:

- a clothing image when shopping,
- a particular letter when searching the keyboard,
- an image of how to fit, looking connecting parts, etc.)
- a simplified pattern, when searching for related ones.

Table 13.   Expanded search for illustration images

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

5.3. Stages of Growth

Growth seems to take forever to start and then begins slowly, but develops a tremendous natural urgency of bigger and more rapid changes, taking it's 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.

The mathematical shapes of these classic progressive (non-linear) growth curves are called "exponential", for changes getting proportionally bigger and "asymptotic" for changes getting proportionally smaller, or "logistic" for equations in which former is followed by the latter to make a shape like that in Figure 4. Natural processes with similar shapes of change over time are often said to follow equations for "positive" and then "negative" "feedback" as the rate of proportional change, but there is no change in the formula anywhere from beginning to end. For natural systems the same shapes are labeled differently.

Here the reference is to the "feedforward" of growth as a non-steady design process. It represents additions that accumulate and by providing a basis for further additions, extending the start-up pattern. That pattern of design by accumulation is readily observed throughout nature as the process by which new forms emerge. So the mathematical and natural pattern way of referring to natural processes are very different, especially in that for mathematical formulas nothing actually changes, and in natural processes something quite new emerges.

It's a highly visible pattern in both personal growth, social change and in local environments, as how individual transformations in complex systems of relationships take place. You see it as a general pattern of transformation for businesses too, political systems, economies too. All follow the same general pattern as found in the growth of plants and animals from fertilized seeds and eggs, all having starting patterns that develop. It's also the pattern of transformation in professional practices of all kinds, design, art and business projects. They all start with some pattern for getting things to work and develop through immature stages to mature ones, by a growth process of efforts in organizing them, and to extend a starting pattern (Henshaw 2015 2.1 The natural process of design).

It's another of the very visible naturally occurring *patterns* with wonderful uses as guiding patterns. We're familiar with "start-up's" that are immature and may 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 businesses and politicians that "overshoot". At all points along the transformation path there are characteristic stories to mine for what matters in the

process of accommodating the change taking place, one can explore using *pattern search* to learn from.

People often use their awareness of how transformations progress to gauge how to proceed with their own projects and designs, seeing when it becomes critical to stop wasting time, or to review concepts at the beginning to see what would be really worth the big effort and investment. Part of what is special about it technically is that it's an organizational process of "accumulation", adding extensions to the foundation concept that often only succeed if they accelerate and develop a "flow". It makes growth a real design "building process" with various critical stages, important to watch for and monitor. Following steps rely on the preceding ones being sound enough to build on and completion to come before using up the available seed resource.

The greatest value, again, is how it changes the perception of the design process, recognizing the whole process of transformation and the whole design being developed together, as they move together from stage to stage toward completion. It's the combination that is the design as a whole. The next most valuable use of the natural sequence of transformations is for organizing the planning and tracking of developments, using the transformational stages of increasing maturity toward completion as a natural transformation timeline. It lets you organize your observations by stages defined by the developing system, as marks for how the design is progressing, and how the pieces fit together with their ascending then descending scales of steps.

Growth as The Pattern Transformation
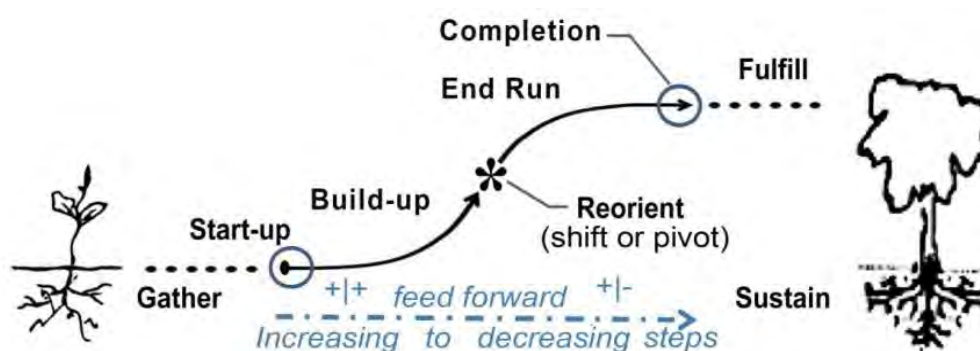
Figure 7.   The stages of living system emergence

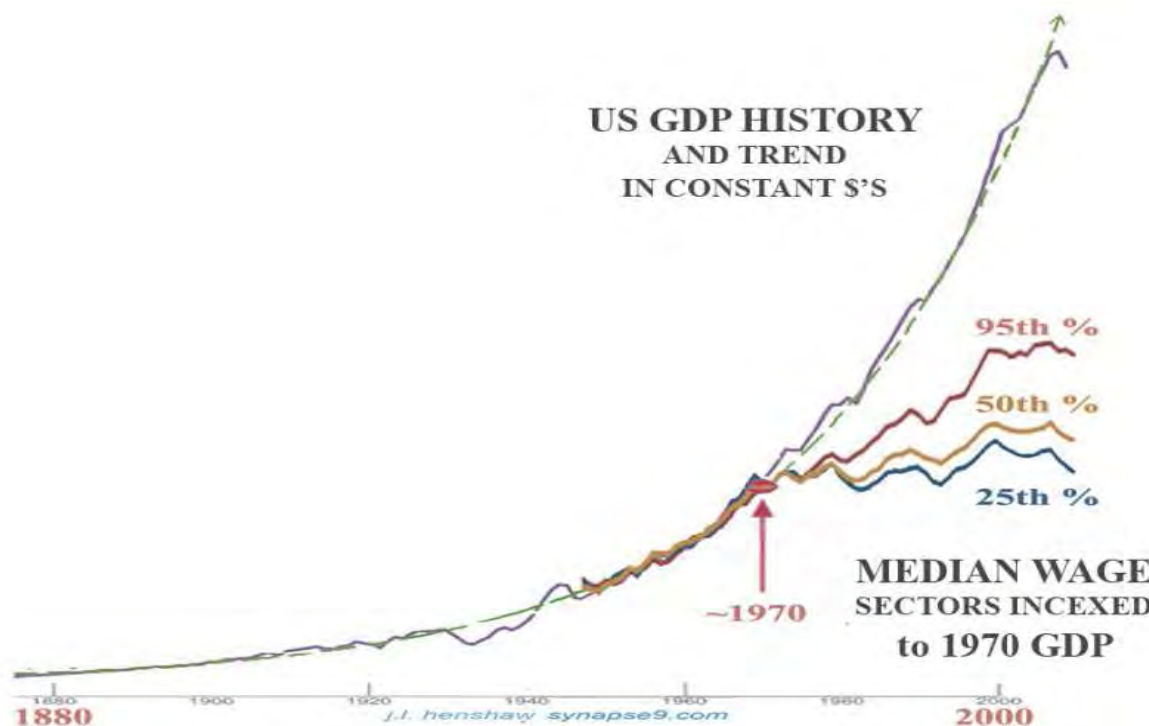Growing Together then Growing Apart

Figure 8.   Reading Transformations

It's beyond the scope of this paper, but worth mentioning. There are a variety of pattern recognition algorithms for natural transformations. An easy pattern to understand it from is this

pattern of a growth system coming apart at the left, (Figure 8)[7].

After a period of all sectors growing together they start diverging. Some appear to be responding to signals of natural limit and others not. You could begin to understand in normal human terms by finding related examples of growth systems coming apart in other circumstances, and finding out enough more to understand the comparison.

You might see this kind of curve in usage data on a software service with a number of products, and making a separate business of the divergent performer. You might find that the divergent performer is scavenging resources from the others, and for some technical or legal reason you can't break them apart. Then you'd have a real problem. That kind of "wicked problem" is the kind of common challenge for understanding or responding to the natural hazards of complex system transformations. The principle issue when discussing internal strains for whole systems is "resilience", the natural ability of the parts of whole systems to share burdens and resources as part of the natural design the allows them to work as a whole.

The informative shape of the curves is the continuity, seeming to reflect the behavior of systematic process, move all together, and then not. A wide range of studies of transformation processes and analytical methods for clarifying the data showing them, was part of the advanced natural systems physics work on which this pattern language method for learning from naturally occurring patterns of design.[8]

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, but seeming not yet studied as a kind of "system design" or "business plan" for individual ways of living. How living systems make their homes in any place they can find how to produces a tremendous diversity, of both kinds of enclosures for housing individuals, families and cultures, to the niches defined by unique ways of using the open environment that do ingeniously avoid conflict with others, allowing 1) a separate a way of living inside from outside, and 2) serving as a center of operations for relationships outside.

We find "homes" in the form of "houses" and "dens", but also "bodies" as homes to both its "cells" and complex biome ecologies, themselves serving as homes to their own highly organized complex living systems. The organization of human culture is organized around homes of every scale, and as diverse roles in our world of differing individual designs for connecting internal with external worlds.

A service professional has their office as their home, their town, their family home, their social groups and professional groups

and national and local governments, all as their homes at once, and find it easy to switch from thinking about the differing issues. 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're 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.
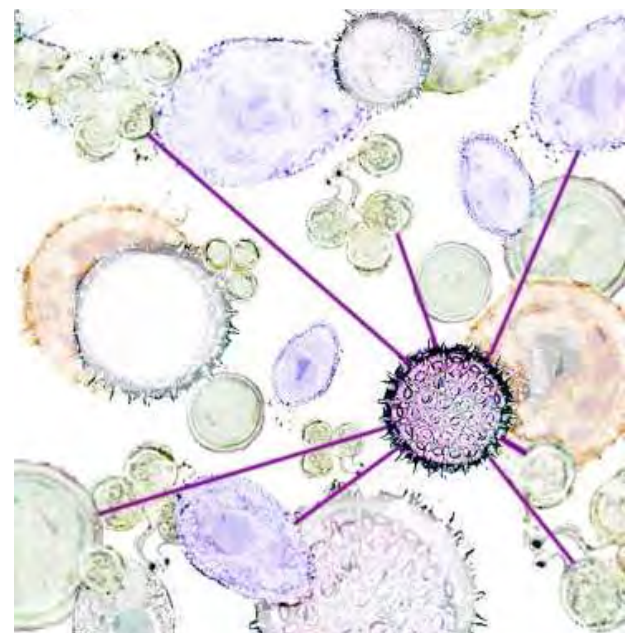
Environments full of homes

Figure 9.   Homes & external connections

Most kinds of habitations can be recognized from their kinds of boundaries. A city doesn't need a wall to be defined by its intense internal culture interlocking parts and outgoing organizations and players. The boundary is whatever is "in the loop" in that case, seeing the whole as its center. That makes it bounded by its own self-sufficient system of internal connections, separated from its surroundings by its local niche of exterior services and connections. The same *pattern* of self-sufficient design with one center is also seen in many other for forms, such as "economies" and "societies", "professions", "craft trades" and "social networks".

Each develops its own internalized culture. On smaller scales you find individual family homes with their own individual cultures, as an internally developed "hive" and *center* of local *design patterns*. 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 an mostly "exclusive space" in a greater "inclusive space". It's a kind of complexity that doesn't yield easily to being "diagrammed" as it has much too much variety of independent associations to even be categorized. So we need to rely on recognizing their individualistic *patterns* and individual internal cultures.

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[7] Figure 8 shows US data from BEA sources, GDP accumulated from 1860 and median income percentiles from 1950, indexed to GDP at 1970
[8] The Physics of Happening – an archive of original research on transformations
http://synapse9.com/drwork.htm

The lines between individual cultures serve to filter access to the interior, by requiring one to respond to the local culture and adopt a role in it, with both trust and change in behavior needed to be welcome.   It also applies to all other kinds of communication between homes, and filtering the exchange of goods and services. Entering any unfamiliar home, a friend's or a business office or a government agency requires much the same preparation for the unknown. Sometimes it's easy take part in other neighborhoods or families, other times not, and usually there's a limit to how far a guest can act as if they belong, that can be tricky. Sometimes trying to act as if you belong where you've never had the courage to try before is a life changing success or a crippling failure. Learning to recognize the patterns could make you seem interested and more welcomed or nosy and pretentious and you might never know.

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're places where old ways are stored and new ones are free to develop.   Why it is that this fairly obvious and widely understood pattern is mostly left out of conversation and not studied either seems mostly due to the life inside *homes* being individualistic and private, and also mostly non-verbal. So there's not much to talk about really, except important to at least know about for learning to work with others…

Because we don't talk about them, though, it does also leave large deficits in our public understanding of how living systems and their relationships work. If they're referred to then, it becomes most often from a viewpoint of ignorance than of the designs of life hidden from view. Pattern language is a way of being explicit in verbalizing the features of holistic designs, to make their needs recognizable from multiple points of view, and might relieve some of those deficits in the common culture as professions adopt and use it.

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As a universal natural *pattern, homes* can be recognized has having a variety of other important common features of living things. They are invariably found to contain their own complete economies, essential to maintaining their resilience, for example. So they also have their own form of "business model" for internal and external transactions too. To work with them and understand what services they need and can offer, some way of recognizing their hidden designs without violating them is part of the challenge. Even what is called "meta-data" can be intrusive and needs a trust to be made good use of. To enhance their own 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 separately designed individual cultures is a major challenge. It's also important to understanding 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.

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For mining *living quality for* the *design pattern*s we work on, 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 didn't 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 own way of exploring these complex relationships by "looking around". When you see how *patterns* are connected in an interesting way you "look around" to see how many viewpoints you can collect impressions of what's happening from.   Alexander's way of writing doesn't 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's also readily traced in the way whole systems develop from their starting seed pattern for many things. It's hard to explain, what it is that starts from a "seed pattern" such as a "hand shake", to start things on their course, but that's as close to the beginnings of them you can actually 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 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 the 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 own 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. "

My approach to the same problem is just to attribute the quality of *wholeness* to the living things that the word refers to, not to the concepts in my mind, but to the natural things where a good observer can learn about it. Things that grow as a whole and display *fitness* in their world and contribute *living quality* to their surroundings are not so rare that you can't find some to study. I do wonder if there's any more special reason not to associate '*wholeness'* with the observable things we recognize the ideal *pattern* of *wholeness* expressed in.

I suppose there must be some reason for Alexander and others discuss it abstractly, given how that term and others have been set apart. So it seems that usage shouldn't be replaced by some other just for convenience. But that doesn't keep people from studying the various things that seem to make them feel whole, a genuine emotional state, or that serve their world in a way that seem to make it whole too.

5.5. Natural Language

Perhaps our deepest and richest repository of natural *design patterns* is our own 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 to, 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. By both naming the natural subjects and conveying associated values for the experience, our own understanding of words can be mined for the uses we are familiar with. The familiar uses direct attention to diverse examples of things and experiences from which the word comes, where the particulars of the *patterns* of relationships can be found and the experience with them recalled. It's a repository of designs everyone already knows a good bit about.

Modern people seem to have less need for understanding where the meanings of their words might have come from, of course. 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 doesn't normally redefine its roots as frequently as our modern word usage seem to, or at ever faster rates as seems actually needed to have words for the multiplying changes in how our world works that seem to have no natural meanings, like "software", or the proprietary use of natural terms like for the "live cloud". The natural meanings are still there and hard to erase but our decisions are being made more and more in terms of words redefined for the abstract theories that have not been working for us, like equating explosively accelerating change with stability, for example. So the way natural language refers back to its roots, pointing directly to recurrent natural *patterns* that have common experience for us all, seems like it may come in handy. It could possibly 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 sentences we usually find them in the added meaning of the sentence is removed, and their rich individual meanings suddenly shine through. That opens doors to appreciating the cultural histories of their meanings, in the range of ways we use them. They let us recall and refresh the deep meanings of our experience with the natural subjects and experiences they refer to.

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 need to be worked with, looking for them from all directions. A common result is that mining the *natural patterns* behind the words used to describe the "*forces*" turns attention to important relationships in the context that never would have been noticed otherwise, and change the whole understanding of the problem being faced.

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's that deep meaning of it that is referred to. Added discussion methods is 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 and 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 really talking about asphalt.

When I noticed that array of evocative uses for 'road' I looked it up in Webster's 1903 Unabridged Dictionary[9]. 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 are connected to the same humble root

word is referring to the same common natural life *pattern* and experience, adding complex understandings 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 a travel, involving important choices to be made along the way (Fig 10)

The *journey* of the road taken ·

Figure 10. Travel as a 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 it10. 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 hidden deep meanings of words and naturally occurring *patterns* and experiences could also be a way to expand and enrich other searches, as those discussed in 2.1 & 2.2 in commenting on Hawasawa et. all. (2014) or Hamner & Mirakhorli (2014). When you find *center words* by studying a *pattern's* service user and provider communities, you can enrich your understanding of them using *word search* in companion with *pattern search*. It use of *word search* can also be used to better understand our accumulated common cultural experience with *patterns* of design and find more related word uses and living examples of *design patterns* to study.

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

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in bridges there 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 pattern*s the words are referring to ground your 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 natural *patterns* of design can enhance the living quality of design patterns of all kinds, and also offer a variety of extra benefits from a way one can reground their language in a confusing time in the timeless relationships of life that language originated from.

Introduction

- Suggestion to readers for how to pause and develop their own 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 l*iving quality*" for validating and enhancing the services application *patterns* provide to their worlds.
  - o Features and terminology added for describing naturally occurring *patterns* of design
  - o The two principle solution strategies to be demonstrated and discussed are:

- ▪ searching in the *design pattern*'s external connections for 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.

2. Application Examples Using PLoP 2014 Studies

- For the method of Harasawa et. all. (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,
  - o 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.

3. Background and Theory

- The need to fill a deficit in our language to discuss the non-steady state but highly organized *patterns* of naturally occurring design,
  - o resulting from science not finding how to describe those natural designs with equations, leaving them mostly unstudied and generally undiscussed.
  - o *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 60's and 70's
- 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
  - o Searching outward along connections with an environment
  - o Searching globally for living examples of a pattern to learn from globally

- o The challenge presented by living systems developing and acting from the inside, by means hidden from view, answered by understanding the observables
- 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, as, as "natural capital".
  - emergent properties from connecting oppositely fitting parts

4. Great *Pattern* Repositories

- The general idea searching for natural patterns using of word association backwards, to turn attention back to the natural experiences the word meanings came from and 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 for
  - o Trails of *patterns*   the 'stigmergy' of nature
  - o Stages of Growth   the working paths of transformation
  - o Habitations   the organizational centers of life
  - o 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
  - o Methods of language search and root pattern discovery

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