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# Pattern Language and HCI: Expectations and Experiences

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**Abstract**

Pattern Language (PL) has been researched and developed in HCI research since the mid-80s. Our research was initiated by the question why something like PL can create such enthusiasm and interest over the years, while at the same time not be more widespread and successful? In this paper, we examine the experiences and expectations that HCI researchers who have been involved in PL research have had and still have when it comes to PL. Based on the literature review and interview studies, we provide some overall reflections and several possible directions on the use of PL in HCI.

**Author Keywords**

Design; Patterns; Pattern Language; Research

**ACM Classification Keywords**

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

**General Terms**

Design

**Introduction**

The notion of *Pattern Language* (PL) has attracted a lot of interest since it was introduced in the late 1970s by Christopher Alexander and his colleagues [1]. There has

also been a strong interest in the field of HCI and interaction design over the years to develop patterns and pattern languages both by practitioners and researcher for the purpose of research as well as for design practice. But to what extent have these attempts been successful?

The design of this study is fairly straightforward. Our basic question has been to examine the experiences and expectations that HCI researchers who have developed pattern languages have had and still have when it comes to pattern language.

From a methodological perspective this history of development and use is a rich source that if studied more closely could help shed light on many aspects related to the nature and role of design methods and techniques in general. Experimenting with, develop and use PL does inevitably lead to interesting research questions around what constitute properties and qualities of methods and techniques and what their consequences may be. Studying PL can be an entry point to a better understanding of design support in general.

Our main research question is therefore: how does Pattern Language situate in today's HCI design and research world? To explore this question we have conducted literature studies as well as an interview study. In our work we have tried to see how pattern languages have been developed and changed in the last decades, who has used and is using PL, and for what purpose. We have also tried to find out whether PL is still of interest to the field and if so why it is seen as useful.

Examining the use of PL in our field (understood in a broad way) is not easy since PL have been used for

many purposes (such as, interface design [4], ethnographic research [18, 24], web usability [23, 25], etc.) and in so many sub-disciplines (such as, ubiquitous computing [6, 22, 26], software engineering [13, 14], Human Robot Interaction [16, 17], etc.). We believe that there are certain aspects of PL that have not been fully explored or understood when it comes to HCI design and research.

### **Related work**

In this paper, we have critically examined pattern language papers published since 2000 within HCI (defined broadly). Our focus has been on how researchers in HCI have understood and used pattern language, what their experiences and expectations have been. We are fully aware that our examination is not comprehensive and that there is definitely other researchers' work related to pattern language that also could have been included.

Pattern language was first introduced by Christopher Alexander and his colleagues in their book with regards to architecture and urban design [1]. A pattern language is a group of patterns that attempt to give a solution to a recurring problem. The first literature that mentioned pattern language is [20]. Although there was no detailed exploration of how to apply pattern language to the field of HCI, Norman claimed that Alexander's work had particularly influenced him. Later on, Thomas Erickson brought up the notion of viewing Pattern Language as "lingua franca" and suggested using Pattern Language as a meta-language to support interdisciplinary work in HCI and interaction design. [10]

#### *Pattern Language in interaction design*

In interaction design, Erickson suggests that the use of pattern language can support and enhance

interdisciplinary work. [9] He describes three main advantages of pattern language in interaction design, namely concreteness and bounding to the situation, reusable in different domains, and amendable to generalization across workplace. [9] In another paper Erickson introduced the notion of viewing PL as a *lingua franca*, which aims to support people with different expertise to contribute to the same design process. Since then, this notion of pattern language as *lingua franca* has been repeated and advocated by HCI researchers and practitioners in supporting interdisciplinary work. [4, 8, 11, 19, etc.] The application of pattern language in interaction design has been further investigated and examined by other HCI researchers and practitioners, such as [26]. This research has mainly focused on using PL to document conventions and analyze user behaviors in user research.

#### *Pattern Language and Ethnographic Methods*

The application of pattern language in HCI has also been done in combination with ethnographic approaches. The use of pattern language has been used to organize and present materials gathered from ethnographic studies, as well as generating design principles. Earlier research work focusing on using PL in ethnography has been elevated by Martin et al. [18]. The same idea of adopting pattern language in presenting ethnographic fieldwork has been reflected and illustrated by Crabtree, Hemmings and Rodden in [7], in which they use pattern language as a means of understanding and conveying the idea of developing new technologies for domestic settings. More recent research include [2] where pattern language is used to document design knowledge and describe solutions for interactive systems in sociable situations, and [24] for utilizing pattern language as a *representational* and

*analytical* tool to describe design in everyday activity and routine at home.

#### *Pattern Language in Ubiquitous Computing*

It is notable that significant contribution has been made by utilizing pattern language as a means of “*capturing and sharing design knowledge*” in the domain of ubiquitous computing. [6, 8, 22] Chung et al. describe the process of generating a pattern language and report on evaluation of using design patterns in ubicomp. In [21], Saponas et al. explore the impact of design patterns in the domain of ubiquitous computing in the home settings and describe design patterns as a prescriptive and communicative tool to support designers to generate and share ideas in the design process. Denef and Keyson present a pattern language that they created for firefighters in their 2012 CHI paper [8].

#### *Pattern Language in Other Related Areas*

One area that pattern language has been effectively applied is user interface design, where concrete design patterns are created for documenting specific interactions and interaction designs. [3, 5, 15, 23] More recently, “*Interaction patterns have been proposed as a means to characterize essential features of human-robot interaction.*” In [17], Kahn et al. present design patterns based on a detailed analysis and explanation of when/how/why pattern language should be used. A considerable amount of collaborative efforts have contributed to create social-technical patterns, although not directly relate to HCI and interaction design, still the diverse topics, such as *Social Responsibility*, *Citizen Science*, *Civic Intelligence* [22], humanity and culture, public participation and value advocacy [12] etc., may promote creativity, collaborative and critical thinking in human-centered design and are also in several cases

related to HCI through the focus on the use of interactive technology.

Taken together it is clear that the reasons for using PL in the literature is diverse and to some extent even contradictory. The authors relate to PL as a “tool” that supports their research purpose while in many ways neglecting the initial ideas of Alexander or other aspects of PL. Even though many of the authors write about PL in a more general sense. Most of the writings is aimed at relating their own work to PL and to argue for their particular use of PL. This lack of more general commentary and analysis of the role of PL in HCI led us to conduct an interview study.

### **HCI Researchers’ experiences and expectations of Pattern language—An interview study**

The overall goal of our interview study was to understand HCI PL experts’ experiences and expectations of using and developing pattern language. By PL experts, we mean people who have developed patterns and pattern languages and who also have written and published about their experiences in the broader HCI community. The researchers we approached were in most cases established and highly regarded senior researchers in the field of HCI. We used insights gained from the literature review to guide and structure our set of interview questions, which were centered around the following four aspects: 1) Reasons for people’s initial engagement with PL; 2) The most rewarding and challenging aspects of developing PL; 3) Reasons why PL, while attracting interest in the field, has not had more impact; 4) Future of PL in HCI field and how to approach that.

We first sent out email to 24 HCI researchers who we consider to be PL experts. In the email we included the interview questions. Our respondents were given the choice to either answer the questions by email or by Skype interview. Therefore, our data include both email responses and responses from Skype interviews. We conducted interviews with 14 of the 24 we asked. Among the fourteen replies (both the email and phone interview), eight agreed to be PL experts and six claimed to be non-experts. However, of the six who claimed them to be non-experts, four agreed that they have been heavily involved with using PL in their own research. Based on our literature study it is clear that this group of fourteen researchers include a majority of the existing PL experts in HCI.

### **Findings**

We present here some of the findings that stood out as interesting in our interviews.

#### ***Initial engagement with PL***

Our interviewees had no problem in remembering why and when PL first interested them. Among those we interviewed, seven mentioned Alexander’s pattern language. In most cases Alexander was mentioned as the initial inspiration that evoked people to start working on PL.

It seems as if most of our experts had some kind of revelation when they first encountered PL. To some, PL was the answer to a problem they were already struggling with. In many cases they mentioned that they found PL to be potentially a way to represent some kind of knowledge that they did not even know they needed.

The reasons for using PL in their own work were more diverse. In some cases the researchers mentioned that

they saw an opportunity in *expanding PL* to an area where it had not been tried before. Others mentioned that they saw the basic idea of PL resonate with their own research attempts at the moment. In some cases the use of PL was more a way of *experimenting with PL* than seeing PL as a suitable method for their own purposes. So, there are basically two answers to why these researchers became engaged with PL. The first is that they saw PL as a suitable method or tool for their existing research purposes and the second is that they wanted to explore, learn, and experiment with PL as a potential general method suitable for HCI research.

#### **Advantages of Using PL**

Our interviewees had a lot to say about the advantages of PL. Some of these advantages were not unexpected since they basically resonate with the general image of PL and also with Alexander's original ideas. We have organized the most frequent and important aspects that we identified below and briefly commented on each of them and provide some quotes.

*Education.* One of the most obvious advantages with PL that is mentioned in the interviews is that it has educational benefits.

*"patterns are a good way of teaching people about user interface design."* (--R1)

*Representing knowledge.* Another advantage that was mentioned frequently by our interviewees was the ability of PL to capture and represent knowledge. The argument for this is that patterns can represent design practice and design solutions that can easily be overlooked by using other design methods.

*"Patterns are more than other things that capture action.... It's very static and hard to capture the*

*idea of action and that type of style. But patterns hold onto it very nicely."* (--R5)

*Identifying interactions.* PL was also mentioned as a tool for identifying interactions in HCI as compared with other design methods.

*"...It [PL] transgresses the line between artifact and technology, allowing us to explore the meaningful interactions people have in these two fields our research focuses on."* (--R11)

Here PL provides a framework for people to explore design concepts and identify core human interactions that exist between the technology and artifacts that people use.

*Documenting conventions and innovations.* Another rewarding aspect of PL that was mentioned is that it supports documentation of both conventions and innovations in design.

*"What patterns do is they give us a place to document what the conventions are, so we actually have a way to understand the current state of the world. And the designers can be more careful in where they are choosing to add novelty."* (--R5)

*Design thinking.* A third area where PL was seen as providing advantages was in design thinking.

*"[PL] Provide a way of thinking about design issues and design solutions. It makes you think..."* (--R8)

The format of patterns was mentioned as a way of "forcing" the thinking in a particular direction and to be careful and diligent with definitions and details. It helps people synthesize information during the whole design process, from perceiving a problem, defining a problem, to formulating a problem and solving a problem.

*Sharing.* Patterns were also seen as beneficial for communication and sharing of knowledge and experiences.

*"PL allows people to share experiences, both right and wrong experiences." (--R2)*

The sharing feature of PL may be due to its nature of acting as a meta-language, which enables people in different roles, such as designers, researchers and end-users, to communicate with each other and share experiences with each other.

*Promote creativity.* PL was also seen as a form of representation that promotes creativity.

*"The most rewarding thing is when people (often students) really seem to 'get it' and apply the patterns creatively in workshops, etc." (--R9)*

### **Challenges of Developing PL**

In the same way as our interviewees mentioned several aspects of PL that they saw as beneficial, they also had a lot to say about the challenges of using PL.

*Too much work.* One serious challenge of developing PL is that it requires a lot of work to develop a good PL.

*"first of all, IT IS AN IMMENSE AMOUNT OF WORK!!! First you harvest ideas for potential patterns, then you seek the evidence (examples where it was used), and then you start writing the first draft, then iterate and publish. Do that 100+ times and it will cost you more than a year of your life!" (--R3)*

*Too formal and hard to organize.* The formalized structure of PL was generally seen as a good way of representing interactions and design practices.

However, they also saw it as a restriction for designers to follow such a formalized structure when doing design.

*"They are overly formal. If you are trying to make them the way they're actually described, they are cumbersome. They are hard to organize. It's difficult to find one that if someone has one that works for you. So we don't have a good structure yet for that. That's my biggest frustration." (--R5)*

*Applying PL in real world.* Not only is the development of a PL a challenge, but getting people to adopt PL in real world settings seems to be even more difficult.

*"The most challenging aspect is getting people to adopt the patterns and use them in real situations." (--R9)*

*Between abstractness and specification.* PLs were seen as in-between constructs, that is, they are not abstract discourse or theoretical texts, but at the same time they are not concrete prescriptions or examples.

*"Examples are very concrete. Scientific principles are very abstract. The first is too specific, the latter too abstract. PL tries to be in-between. Pattern languages attempt to be a generalization of multiple examples, in between the vague abstractness of theory and the too-specific instantiation of an example." (--R13)*

### **Reasons for PL not being more successful in HCI**

From the interview feedbacks, part of the reasons for why PL has not been more successful in HCI are the same as the challenges of developing PL. Here we include some other factors that are additional to these challenges that also contribute to why PL has not been more successful.

*Formalization.* One notable factor that causes PL not being more successful in HCI is its formalized structure. Several researchers mentioned that PL is currently being used and achieving more success in programming and computational areas than in HCI and interaction design related fields. However, when it comes to HCI and interaction design, the formalized structure of PL seems not work that well.

*"Designers on the other hand resist formalizations, particularly descriptive ones rather than generative or process-oriented ones like design methods."* (--R10)

*Demand extensive efforts.* Once again, the effort that has to be invested in PL to be successful was seen as a major reason for the overall lack of success. It requires extensive amount of collective efforts and sufficient experiences and knowledge in order to develop a real and good PL.

*"Rigorous is difficult. It is difficult to do [create PL] in a very good way. If you sloppy away, it [PL] doesn't provide you with good insights."* (--R8)

*Lack of validation/evaluation.* Another reason why PL is not gaining much attention nowadays is because there is a lack of empirical research aimed at evaluating the effectiveness of PL.

*"...not enough people are doing empirical work to evaluate claims about PLs, or to study the embodied pragmatics of using PLs in design settings."* (--R6)

*Dynamic nature of technology and design.* Several PL experts expressed the same idea when it came to the contemporary usage of PL in relation to the dynamic nature of technology and design.

*"Nothing in design is static. Think the lack of staticness means the values of the patterns are always very short, particularly in interaction design..."* (--R5)

### **PL Expectations and Future**

When we asked the PL experts about their opinions on the future for PL in HCI and design field, eleven out of fourteen researchers' responses were positive. They also provided some suggestions on what we need to do to make that happen.

*Creating PL rather than simply patterns.* When it comes to design, PL seems to be more promising than patterns.

*"One sort of weakness in design patterns, especially if it is done by multiple distributed people in a bottom-up fashion, is a lack of a coherent pattern language."* (--R1)

*More evaluation.* Indicated by our literature review and interviewee's previous comments, it is critical to conduct more empirical research work to examine the effectiveness of PL in real design settings.

*"More research examining the practicalities of using PLs within actual design processes. Ethnographic & empirical studies are needed."* (--R6)

Even though these suggestions are not particularly detailed, it was clear that most of our interviewees did see a future for PL in HCI, and several of them were actively engaged in how to make that happen.

### **Discussion**

Pattern Language has been both a topic and a method in HCI research since the mid-80s. In contrast to many other methods and approaches developed or adopted by HCI, PL has survived over almost four decades in the

field and is still attracting interest. Even though the theoretical interest in PL maybe culminated a while back, manifested in some more general critiques of the philosophical aspects of PL, the everyday involvement with PL among HCI researchers have not diminished. However, it has neither increased.

Maybe the most interesting question is why something like PL can create such enthusiasm and interest at the same time not be more wide spread and successful? Even though our interviews do not give a straight answer to this question it is possible to find some potential answers by interpreting the responses we have received.

First of all, it is obvious that some (many) researchers in an initial stage almost “fall in love” with the idea of PL. It seems as if the highly structured way of approaching the task of *representing knowledge* as patterns is highly appealing.

Another insight from our interviews is something that is quite well known by those with some experience with PL but is still worth mentioning. Almost all interviewees emphasized the work and effort that has to go into the development of patterns. Taken together, this means that *good patterns take time* to develop. Developing a PL is therefore not something that can be done for a particular situation or a specific problem. There has to be a long-term goal and need for a PL to be worth the investment of time and effort.

Another insight is that a *PL is not a research method*. In order to be able to develop a PL a lot of research needs to be done, with the use of other design and research methods. A PL is only a method for knowledge representation, not a research process method. This means that to transform research results and findings

into a PL lead to additional effort after the “regular” research has been conducted.

There is a similar aspect of effort and time on the use side of PL. As many of the interviewees stated, a PL is *not a prescriptive tool for design*. In order for PL to be used in an intended way, it requires users (designers) who spends a lot of time to become familiar with the set of patterns and to develop a sensibility to when and how each pattern can serve as an inspiration for a design. There is no causal relationship between a pattern and a particular design, instead, for each design situation a designer’s judgment has to mediate inspiration and knowledge from the patterns to fit the design situation at hand. This requirement means that the use of PL is not something easily done by inexperienced designers, instead, the expertise and skill needed by those who develop a PL is also needed by those who attempt to use it. This is probably one of the most frequent misunderstandings of PL. Since the format of PL is highly structured and well defined, it is easy to mistakenly assume that PL is easy to work with and to understand for inexperienced designers.

So, why are these researchers after all these challenges with PL still devoting time and energy to develop new PL. Well, there are several positive aspects of PL that keep surfacing in our interviews and in the literature.

First of all, something we have already mentioned, a PL makes it possible to develop *rich but simple descriptions of highly complex situations and contexts*. At the same time, and maybe more importantly, PL allows for this richness while being *a highly analytical approach*. Patterns are strictly formatted and do not allow for free form (endless) text, instead it forces researchers to be selective, focused and “formal” in a way that other knowledge representation formats for similar purposes



usually do not. There seems to be something intriguing and attractive about the formal and analytical aspect of PL. It is also probably the case that the strict format has a strong *aesthetic aspect*. To shape a concise and well-developed pattern, with appropriate images or graphics, and a well formulated text can be a rewarding exercise in clarity, structure, argumentation, and logic. This could also explain why quite many researchers engage in the creation and development of PLs while quite few are engaged in using already existing PLs. The reward is in the design process itself and less in the practical value of the PL from a use perspective. This would to some extent explain why there is a constant stream of new researchers getting involved with PL over the years while very few examples of researchers involved in analysis or evaluation of existing PLs.

### **Implications and conclusion**

Our research show that PL in HCI has not served as a real practical design tool in almost any case. The PLs that have been developed are usually not deployed in any larger scale; instead PL has been used in some smaller use studies and example studies. It is therefore highly unlikely that PL will (soon) become a successful and widespread practical method for interaction design practice. At the same time, the overall positive response from our interviewees are a definite sign that there are aspects of PL that makes it interesting from a research point of view. One of our main contributions can therefore be summarized that there is a need for research *about* PL instead of *with* PL. PL is an approach with many intriguing contradictions, for instance, the way PL is highly structured while being rich and flexible, the way it is difficult but rewarding to develop, the way it attracts interest over time and evokes strong views and emotions but are not used in practice. We see these contradictions as potential aspects that could be

examined more closely. Finally, we believe that insights from a closer study of PL would potentially be more valuable in the creation of knowledge around methods in general and could lead to general insights about methods and their use in the field.

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