Pattern Languages in the Wild: Exploring Pattern Languages in the Laboratory and in the *Real World*

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ABSTRACT
For more than two decades much of the pattern language literature, within the field of Human Computer Interaction (HCI), has focused on the possible benefits pattern languages may provide, but there has been very little empirical work to support these claims. In fact, existing controlled studies show practically no benefit of using pattern languages in design. Despite this lack of evidence, interest in pattern languages continues. In this paper we examine how pattern languages are used in experimental settings and in the real world. We explore two questions here: Are pattern languages real? Are pattern languages useful? We argue that the answer to both of these questions is *yes*. As a community, we believe that we have been looking in the wrong places to find evidence of pattern languages and have been looking for the wrong benefits. Said differently, we have been overlooking the existence of and the benefits of pattern languages. This study began exploring pattern languages in a laboratory setting, but then continued that exploration in a real setting where we encountered evidence of the existence of pattern languages and of their benefits. By continuing these explorations, we argue that, the HCI community will then begin to see the benefits from all the great efforts in this area.

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Pattern Languages, Interaction Patterns, Design Patterns

ACM Classification Keywords
H.1.2 User/Machine Systems, H.5.2 User Interfaces

1. INTRODUCTION
For decades patterns and pattern languages have been discussed in HCI literature. In much of the literature the focus has been on the possible benefits of using patterns to design interactive systems. Benefits often mentioned include supporting the reuse of solutions to common design problems, providing a common language, or a lingua franca [19], that both designers and non-designers could use to communicate, and aid the capture and sharing of design knowledge [16].

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Pattern languages for architecture and urban design were introduced by architect Christopher Alexander and his colleagues [2],[3] three decades ago. The intention of a pattern language, as described by Alexander [2],[3], was to capture the heart of successful solutions to recurring design problems in architecture and provide a common language that architects and non-architects could both use to communicate. The aim of Alexander's pattern language is to build things which have what he refers as the *quality without a name*. Alexander [2] explains "there is a central quality which is the root criterion of life and spirit in a man, a town, a building, a wilderness. This quality is objective and precise, but it cannot be named" (p. 19). The quality that he refers to makes the spaces and the people in those spaces feel alive and whole. The goal of documenting a pattern language was to capture and describe the quality without a name so that others may understand the quality and the context in which it exists.

In the early 1990's the software engineering community caught onto the idea of using patterns to support the re-use of quality software components. The most well known example of the use of patterns in the software engineering community is Gamma, Helm, Johnson, & Vlissides [23], commonly referred to as the *Gang of Four* book. The growing interest in recent years in patterns and pattern languages in HCI is reflected in the number of workshops, panels, books, and websites dedicated to the topic [18],[21], [50],[52],[58],[62].

Within the HCI literature much of the focus has been the promise of pattern languages [45], or the possible benefits they may provide. There has also been a heavy focus on the problems with using patterns in HCI, some of which include: lack of tool support, lack of a standard format, and lack of an organizing principle [8],[20],[52],[63]. Another problem discussed in the literature is the misunderstanding or misinterpretation about the difference between a pattern and a pattern language [11],[15],[20],[35],[59].

Although there has been a great deal of interest in this area, there is very limited empirical work to support the claimed benefits. In a broad review of this area titled *Pattern Languages in HCI: A Critical Review*, Dearden and Finlay [15] note *"it is clear that significant contributions have been made in the development of patterns and pattern languages which have been employed in the design of real systems (e.g., Borchers, 2001a, van Duyne et al 2003). However, although the use of patterns is reported, there is little concrete evaluation of either the usefulness of pattern languages within the process or the contribution that they have made to the quality of the end product or to the design process…"* (pg. 85).

We briefly review current research on pattern languages below. The results of this research are clear. There is no demonstrated impact of a pattern language on the design of interfaces in the

early stages of design. Why this is the state of current research and whether pattern languages have value elsewhere is the focus of our research.

In this paper, will address the following themes:

1. Do designers use patterns when designing interactive systems? If so, how do they do so and does doing so effect design quality?
2. Do patterns appear in commercial systems? And, if they do, is there any correlation between pattern use and system usability?

2. RELATED WORK

While much of the literature has focused on the promise of pattern languages [45] or the possible benefits they provide, there has been little empirical work to support these claims [15]. Since we are focused in this paper on the use of patterns to support design, we limit this review to this topic. Interestingly, this empirical work, we review, considers *pattern-like* structures rather than actual *patterns.*

There have been relatively few empirical studies which examine the impact of patterns on design and evaluation in HCI [9],[12],[14],[15],[24],[25],[48] Borchers [9], Dearden et al. [14],[15] and Finlay et al [22] report on various studies in which users were asked to use interaction patterns in various design activities. While these studies shed light on how patterns may be used in HCI education, the role a facilitator may play in designing with patterns, and how patterns may empower users, they provide little information about the impact of patterns on the quality of the resulting designs. Golden, John & Bass [24],[25] report on a controlled experiment designed to examine the impact of different parts of Usability-Supporting Architectural Patterns (USAPs) on the modification of a software architecture design, in terms of the number of cancellation responsibilities considered and the quality of the designs. While these studies do consider the impact of USAPs on the quality of the designs, the USAPs are similar to interaction patterns, but not exactly the same. Of these studies only Chung et al [12] and Saponas et al [48] were able to conduct controlled experiments in which the use of interaction patterns could be compared to a control condition.

Chung et al. conducted a controlled experiment in which pairs of designers used 45 *pre-patterns* to design a location based service for a shopping mall. These are termed *pre-patterns* because they are for a nascent rather than an established domain; in this case location based services. Their results indicate that the pre-patterns had no apparent impact on the designs in terms of creativity, completeness, and quality. They suggest that the pre-patterns helped novice designers and those new to the domain. Their results also suggest that pre-patterns helped designers generate and communicate ideas, in addition to helping the designers avoid problems in the early stages of the design process.

Saponas et al. [48] conducted a controlled experiment in which pairs of designers used 48 pre-patterns to design a home food inventory system. Their results indicate the pre-patterns had no apparent impact on the designs in terms of level of detail, completeness, and quality. However the detail scores for the control group were on average higher than the patterns group. They suggest that pre-patterns helped the designers generate ideas and communicate. The Chung et al [12] and Saponas et al [48] studies have in common that they used pre-patterns rather than patterns. They also have in common that they suggest that pre-patterns helped designers generate ideas and communicate. *The use of pre-patterns, however, had no impact on the quality of the resulting designs.*

Golden, John, and Bass [24],[25] did demonstrate that complete Usability-Supporting Architectural Patterns (USAPs) improved performance in a software architecture redesign task, with no increase in task completion time, when compared to partial USAPs. A complete USAP consists of (1) a usability scenario, (2) a list of general responsibilities that should be considered in the implementation of a software function, and (3) a sample solution. The combination of all three was better than the first component alone or the first and second combined.

Golden et al suggest that the full USAP with all three parts (scenario, list of responsibilities, and example solution) is similar to interaction patterns described in HCI. While similar, they are not identical. More importantly, USAPs are individual patterns and are not linked in a *pattern language.* A pattern language describes how the individual patterns are related to each other. It is the *language* rather than the individual *patterns* that facilitates the design of useable artifacts. The lack of most current research to focus on *patterns* rather than on *languages* has also been noted by others (e.g. [20],[63]).

In summary, we have limited this review to the use of patterns to support design. The results are clear that there is no documented benefit of using pattern languages in early stage design. However, we note that existing research is primarily focused on *patterns* rather than *pattern languages* and the use of *pattern-like* structures rather than on *patterns.* We address these deficiencies in the research reported here.

3. OVERVIEW OF THIS RESEARCH

We seek to extend previous research on patterns in HCI by exploring two themes. The first is to investigate the impact of a pattern language on the design of interfaces at the early stages of design, in terms of quality of the designs and the time to design the interfaces. The second is to investigate the existence of pattern languages in commercial systems.

To examine the impact of a pattern language on the design of interfaces, we needed a pattern language that would lend itself to an experimental setting, in that we needed a pattern language that would allow the participants to design a set of simple coherent system interfaces. Although there are a few published pattern languages, including van Duyne et al's [61], that would lend themselves to experimental settings, we could not find a pattern language that included a substantial number of patterns that focused on a particular domain.

Therefore over a period of six months we discovered and constructed an information retrieval pattern language (aIRPLane) which consists of 39 patterns. Since there is no published method for this within HCI we followed Alexander's [2] process of discovery; described below.

In all of the controlled experiments previously conducted the designs of a patterns group were compared to the designs of a control group. In this study we have added a third group -- a guidelines group. Guidelines were chosen because they are commonly compared to patterns in the pattern literature [26],[27],[32]. Molich and Nielsen's [40] guidelines were selected to be used because they are recognized as one of the three most influential sets of guidelines [56] and because Molich & Nielsen's [40] claim that almost all usability problems fit into one of the

categories addressed by their guidelines. Recently Nielsen [43] addressed the claims that usability guidelines from years past may be obsolete and concluded that the majority of the guidelines from 20 years ago are still valid. Over the years Molich and Nielsen's guidelines [40],[41],[42] have changed slightly. The most simple and complete version seemed to be the [41] version therefore this version was used.

The aim of this study is to contribute to our understanding of how a pattern language impacts the design of interfaces, at the early stages of design, in addition to investigating how the use of patterns in existing systems impacts the usability of those systems. Our results provide new insights into how patterns may be of value in design, evaluation, and communication.

3. THE DISCOVERY OF A PATTERN LANGUAGE

aIRPLane (an Information Retrieval Pattern Language) was discovered and constructed over a period of six months by interacting with 30 commercial information retrieval systems (see Figure 1). These 30 systems were selected by listing all information retrieval (IR) systems available through the Drexel University Library and eliminating those which were restricted and specialized (e.g., accessible only by law students and faculty).

Six tasks were performed on each of the 30 systems multiple times. These tasks were selected to be those commonly done by users of information retrieval systems as indicated in well known information seeking models of user behavior [6],[17],[33],[38].

The tasks were:

1. Perform general search for *interaction patterns*
2. Examine results
3. Look at help
4. Perform advanced search for *interaction patterns and human computer interaction*
5. Examine results
6. Browse contents of system (for *interaction patterns*)

Alexander [2] points out that patterns may be discovered in different ways -- by identifying a problem and later finding a solution or by seeing a positive set of examples and therefore recognizing a solution. Alexander [2] describes how this is a process of discovery, "a pattern is a discovery in the sense that it is a discovery of a relationship between the context, forces, and relationships in space" (p. 259).

While interacting with the systems, problems were identified and noted. The systems in which the problems did not occur were revisited to see how they addressed the problems. A solution was then noted for each problem. And three examples of each solution were captured. As more and more problems and solutions were discovered the relationships between the patterns became apparent and were documented.

One example of a pattern (for *Indicate Search Terms in Result Set)* is shown in Figure 2. The network of patterns that comprise the pattern language is shown in Figure 3. The network map of the patterns shows some of the relationships between the patterns in the pattern language. For the sake of readability all of the relationships are not shown. The marker shapes in this figure will be explained later.

The format of the patterns in aIRPLane is consistent with other published formats within HCI [58],[62].

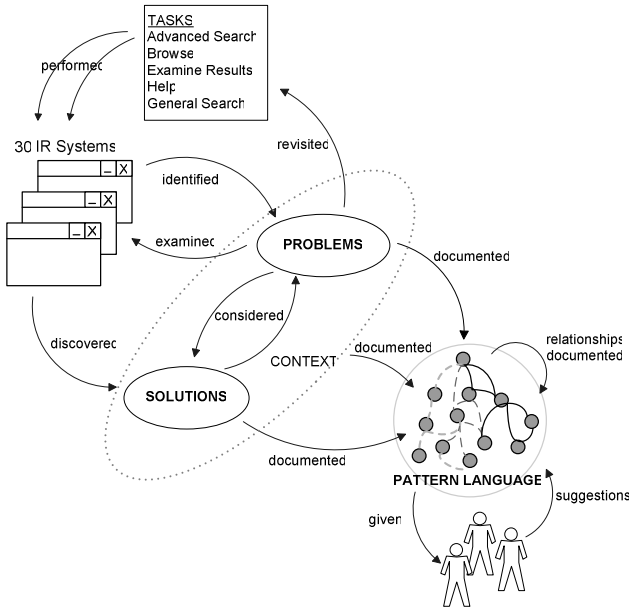


Figure 1. The Discovery and Construction Process

Each of the 39 patterns in aIRPLane contains the following sections:

- Name and Image
- What
- Use When
- Why
- How
- Examples
- How this pattern is related to others

We are in no way implying that this is the only possible pattern language for information retrieval systems. In keeping with the view of pattern languages proposed by Alexander [3], this is *a* pattern language, not *the* pattern language. In addition, we are in no way implying that this language is complete. While this language is complete for the tasks used in this experiment, it does not encompass all of information retrieval. In addition, we have a list of patterns we wish to add in the future.

4. EXPERIMENT 1: THE IMPACT OF A PATTERN LANGUAGE ON EARLY STAGE DESIGN

We evaluated the impact of aIRPLane on the design of early stage interfaces. To avoid the *something to nothing* comparison that would result in using only a patterns condition and a control condition, we added a third condition which used guidelines (e.g., [40]). We elected to use guidelines as a third condition both because they are frequently used in the HCI community and because they share some similarities with patterns [26],[27].

4.1 Participants

Fifty-two participants completed the design task. They were each paid $15 for their time. All participants were students at Drexel University who had taken at least one HCI course. The participants were randomly assigned to one of the experimental conditions: patterns condition, guidelines condition, and control condition.

Indicate Search Terms in Result Set

From http://vnweb.hwwilsonweb.com/hww/login.jhtml

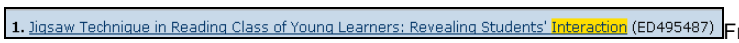
What: The user's search terms should be differentiated from all other words in the result set.

Use When: Whenever a user's search term appears within the result set it should be differentiated from the rest of the words in the result set no matter where it appears.

Why: The user's attention should be drawn to the terms they included in their search query. Users are presented with a lot of information after they execute a query. The user is trying to find information related to their search query therefore when the terms a user included in their search query appear in the result set they should be indicated or differentiated in some way from all other terms in order to help users find information relevant to their query.

How: Search terms should be indicated in the result set by differentiating them from other words in the results set. This can be done by highlighting the search terms, bolding the search terms, italicizing the search terms, changing the color of the search terms, etc.

Example:



From http://www.eric.ed.gov/ERICWebPortal/Home.portal

How this pattern is related to others: This pattern is related to *Result Set* and is a part of *Result Record*.

Figure 2. Example Pattern from aIRPLane

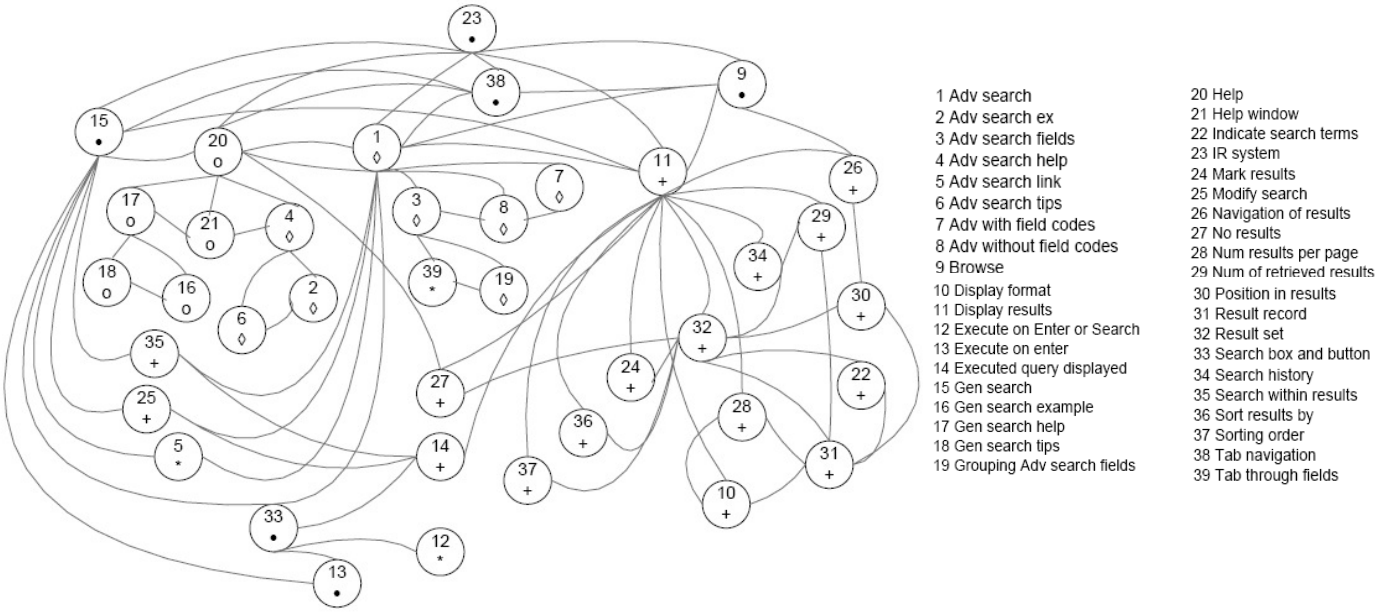


Figure 3. Network Map

4.2 Procedure

A between-groups design was used. There was one independent variable -- design technique -- with three levels: patterns, guidelines, and no technique. There were five dependent measures: ease of use, completeness, level of detail, overall quality, and design time.

Participants were asked to fill out a pre-test questionnaire. They were then given the design task. The design task included a brief scenario and list of requirements. The participants were given an hour to create the designs using a design template (paper with boxes to draw the interfaces on), pencils, and pens.

Those in the patterns group were given an overview of patterns, which included a description of patterns in HCI and an example of a pattern. After receiving the design task and the tutorial, but before beginning the design task, participants in the pattern condition were asked to sort and categorize the patterns using common card sorting techniques [13],[39]. The 39 patterns in aIRPLane were given to the participants in random order. The participants were instructed that there was no right way to sort the patterns. They were told that they could create as many piles

as they would like with as many patterns as they would like in each pile. The participants were then asked if they had any questions. If there were any questions they were addressed.

Those in the guidelines group were also individually given an overview of guidelines, which included a description of guidelines in HCI and an example of a guideline. They were then given the 10 guidelines, in random order, and asked to review them. The participants were then asked if they had any questions about guidelines. If there were any questions they were addressed. Those in the guidelines group were not asked to sort the guidelines because of the limited number of guidelines.

Those in the control group did not receive anything other than the design task. After completing the design task all participants were asked to fill out a post-test questionnaire.

All the resulting designs were then evaluated by two experts. Both experts were Professors of HCI with many referred publications and decades of experience conducting related research, teaching, and designing and evaluating interactive systems. The judges rated all of the designs on four subjective measures: ease of use, level of detail, completeness, and overall quality, using a seven-point Likert-like scale. The scale ranged from "Not at all Detailed – 1" to "Very Detailed – 7" for level of detail. Each evaluator was given a standard definition of each quality element (see Table 1).

Ease of Use	How easy is it to use the interfaces?
Level of Detail	How low level, readily implementable, and non-vague are the elements of the interface?
Completeness	How complete is the design? Does the design contain all the necessary parts that it will need to work?
Overall Quality	Overall, how good of a solution is the design?

Table 1. Subjective Measures to evaluate the quality of the designs

The definitions for level of detail, completeness, and quality were taken from Saponas et al. [48] and are similar to those used in the Chung et al. [12] study.

4.3 Experiment 1: Results

In this study, SPSS was used to analyze inter-rater reliability. This was done using two-way mixed model, intraclass correlation [53]. The intraclass correlation coefficient was .82 indicating a high level of agreement.

The three experimental groups' scores were compared using one-way between groups ANOVA for *ease of use*, *level of detail*, *completeness*, and *overall quality*. There was no statistically significant difference at the $p < .05$ level in any of the four scores for the three groups (ease of use, $F(2, 49) = .32$, $p = .73$; level of detail, $F(2, 49) = .35$, $p = .70$; completeness, $F(2, 49) = 1.50$, $p = .23$, overall quality, $F(2, 49) = .63$, $p = .54$). The actual difference in mean scores between the groups was quite small, see Table 2.

	Ease of Use	Level of Detail	Completeness	Overall Quality
Pattern	3.53	3.82	4.88	4.00
Guideline	3.19	3.47	4.31	3.56
Control	3.44	3.53	4.68	3.82

Table 2. Results of Subjective Evaluation

4.3.1 Time to Design Interfaces

The time taken to design the interfaces was recorded and compared across the groups. There was no statistically significant difference at the $p < .05$ level in design time for the three groups $F(2, 49) = .63$, $p = .54$. The actual difference in mean scores between the groups was quite small, see Table 3.

	Average design time (min)	Average time on technique (min)	Average overall time (min)
Pattern	21.0	17.6	51.7
Guideline	23.4	3.8	37.4
Control	19.6	--	29.7

Table 3. Design Time

4.3.2 Patterns and Pattern Languages

To further understand the "language" aspect, the sort data resulting from having the participants sort the patterns was input in a co-occurrence matrix. The resulting co-occurrence matrix was converted to a matrix of correlation coefficients. This matrix of correlations was used in further analyses including: hierarchical cluster analysis and multidimensional scaling (MDS). This was done to examine the participants' overall perception of the pattern language and the relationships between patterns.

Using multidimensional scaling, the sort data is mapped into a two-dimensional map (see Figure 4). The R-square = .66 and stress = .26 (Young's S-stress formula 1 is used). For ease of interpretation, we show this map in two dimensions and note that the three-dimensional map is slightly better with R-square =.77 and stress = .17. Pattern languages are a network of interdependent patterns and aIRPLane is arranged into such a network, as seen earlier in Figure 3. In addition, the higher level patterns in aIRPLane, such as *general search*, are made up of lower level patterns, such as *search box and button*, *advanced search link*, *help*, and so on. It is also important to note that the place at which the lines enter the patterns in the network diagram signifies the type of relationship between the patterns. If the line enters a pattern from the top, this pattern helps make up the higher level pattern. Whereas if the line enters a pattern from the side, the patterns are related to one another is some other way.

Here the cluster membership shown in Figure 4 is designated in Figure 3 by using different marker shapes. Those identified as being a part of the *Results Features* cluster have a "+" marker. Those identified as part of the *General IR Features* cluster have a solid circle marker. Those in the *General Help* cluster have a hollow circle marker. The patterns in the *Advanced IR Interactions* cluster have a "*" marker. Those identified as part

of the *Advanced Search Features* cluster have a hollow diamond marker.

Inspection of the MDS map and the network map presented earlier, enhanced with the cluster membership, suggests that the participants viewed the relationships between the patterns in a similar manner to the way we viewed the relationships between the patterns prior to conducting this study. This can be clearly seen if the patterns in each cluster are identified on the network map as seen above in Figure 3.

In summary, there are no statistically significant differences (at the .05 level) between the groups for any of the 4 quality variables. Nor are there any statistically significant differences between the groups for the time to design the interfaces. However, the results of the card sorting exercise, as analyzed using hierarchical cluster analysis and MDS, suggest that the participants tend to see a common arrangement of the patterns in aIRPLane.

4.4 Experiment 1: Discussion

In this study, aIRPLane did not have an apparent impact on the quality of the designed interfaces or the time to design the interfaces. There were no statistically significant differences (at the .05 level) found between the groups for the quality of the interfaces (as measured by ease of use, completeness, level of detail, and overall quality). This is consistent with the findings of other studies in this area [12],[48].

Below, we would like to explore why we may expect a pattern language to have an impact on the design of interfaces.

4.4.1Revisiting the Promises

At first, it seems somewhat surprising that the results of this study suggest that a pattern language had little or no apparent affect on the design of information retrieval interfaces, especially considering the claims made in the literature about how patterns may be useful design tools. But, if we revisit the empirical studies that have been conducted in this area, [12],[48] they too found practically no positive effect on the quality of the designs or the time to design the interfaces due to the patterns. In both Chung et al. and Saponas et al. a patterns condition was compared to a control condition. And in both studies there was practically no difference between the groups in terms of the quality of their designs.

So the obvious question to follow is: Why is it that there is no effect of the patterns on the quality of the designs? We believe it is fairly safe to assume, although it was not asked, that all the participants, in this study, have used some type of information retrieval system before. And as we describe in the following sections the patterns in aIRPLane exist in many systems, systems that these participants have most likely been in contact with (described further in [64]). If they have not been in contact with the traditional IR systems, it is fairly safe to assume that most, if not all, participants have used Google, Yahoo, or a similar web search engine. It is therefore safe to assume that the participants in this study have been in contact with some of these patterns in the past.

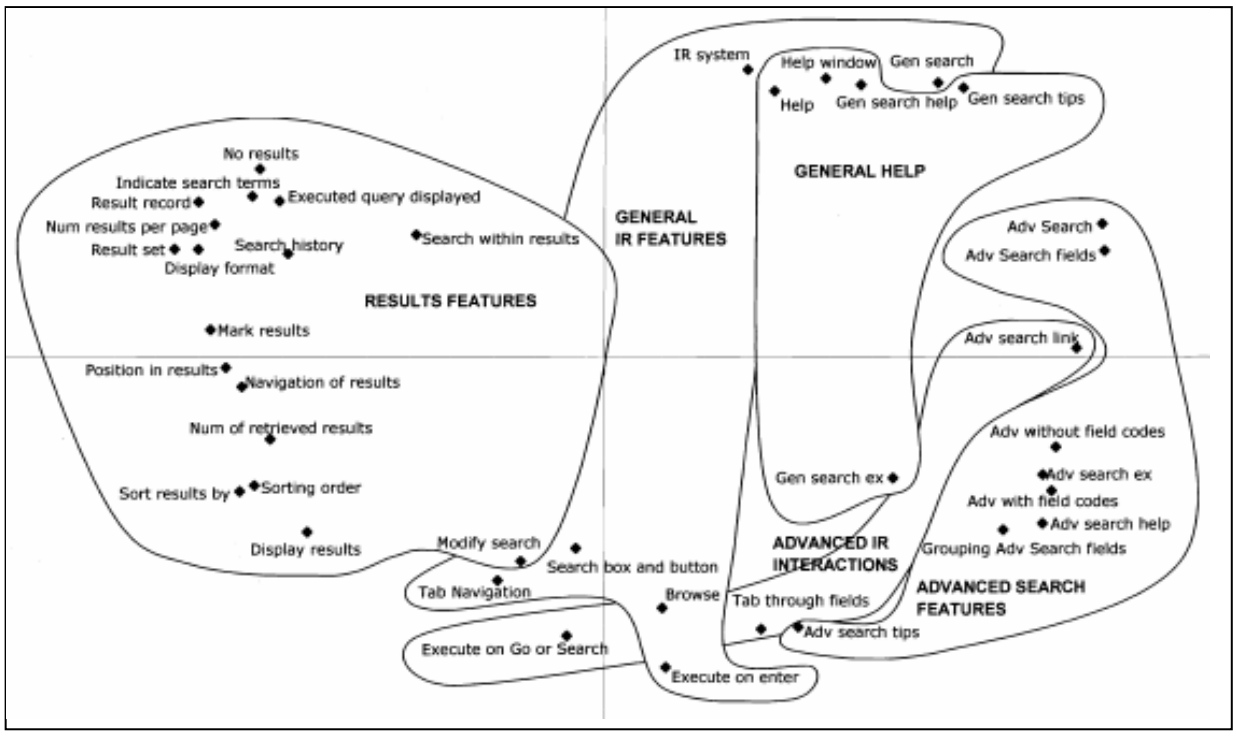


Figure 4. 2-dimensional MDS map

Following on this point, it seems reasonable that the participants relied on their knowledge and experiences using IR systems to help them design the IR interfaces in this experiment. We would like to acknowledge that this is an aspect of this study that is unlike other empirical studies in this area.

In both Chung et al [12] and Saponas et al [48] some of the participants were not familiar with the domain in which they were asked to create a design. As suggested by Saponas et al. if the participants in this study were asked to design interfaces for a system with which they were not familiar, the results of this study may have been different. But even in previous studies, such as Chung et al. and Saponas et al., in which not all designers were familiar with the domain in which they were designing, the designers stated that they believed that patterns would be useful to those who are not familiar with a domain. Yet the results to support this claim are anecdotal, not quantitative measures.

In answer to the question posed above, it could be that there was no effect of the patterns on the quality of the designs because all the participants were in fact using patterns. Is it very possible that the participants were using the patterns they were familiar with, and had been in contact with previously through their use of IR systems and search engines, to help them design the IR interfaces.

In an attempt to further illustrate this point we would like to introduce a simple thought experiment here. Suppose we gave a number of participants the task of designing the layout of a house. Let's imagine they were asked to design a one story house with three bedrooms, two bathrooms, a kitchen, living room, and dining room. Now, let's suppose we gave half of the participants some patterns from Alexander's pattern language [3] (or any other architectural pattern language) and the other half were left to design the house layout without any structuring technique. It is reasonable to assume that we would not expect the participants in the two groups to design drastically different layouts for the house.

We would not be surprised if the layouts looked similar and consistent with the patterns in Alexander's pattern language. We would not be greatly surprised if everyone included some type of foyer or entranceway into the house. We would not be surprised if they all placed the kitchen and dining room next to each other and we would not be surprised if bathrooms were placed near bedrooms.

4.5 Experiment 1: Follow Up - Did Experimental Subjects Use Patterns?

That the explicit use of patterns did not influence the ease of use, level of detail, completeness, or overall quality of designs does not mean that subjects in the pattern condition did not use patterns. In *The timeless way of building*, Alexander [2] does not talk about patterns as aids to designers but as the common understanding of *good* quality that emerges after extensive experience interacting with artifacts. Since all of our subjects had experience with interactive systems, it is possible that all groups were familiar with patterns and, without conscious effort, used patterns in their designs.

To explore this possibility, we examined the participants' interfaces to identify which patterns existed in the designs. After the patterns were identified in all the participants' interfaces, one table was created to compare the number of patterns which were identified in the participants' interfaces for the different conditions. A one-way between-groups analysis of variance was conducted to explore whether there was a difference in the number of patterns used in the participants' interfaces across the groups. The independent variable was the condition with three levels: patterns, guidelines and control. The dependent variable was the number of patterns identified. There was a statistically significant difference in number of patterns used for the three conditions $F(2, 49) = 7.10$, $p < .05$ (see Figure 5).

Post hoc analyses using Tukey (HSD) post hoc criterion for significance indicated that the number of patterns used was significantly higher in the patterns group than in both the guidelines group and control group. These analyses suggest that the participants in all conditions used the patterns in aIRPLane, those in the patterns group more than the other groups. However, it is clear that all groups are using patterns. While the patterns group used about 17 patterns, the guidelines group, which used the fewest, used about 13 patterns.

In an effort to investigate the relationship between the number of patterns in the systems and the quality ratings assigned by the experts, Pearson's correlation was computed. There was a significant positive correlation between the number of patterns present in the participant's interfaces and the ease of use rating ($r = .48$, $n = 52$, $p < .05$), the level of detail rating ($r = .55$, $n = 52$, $p < .05$), the completeness rating ($r = .50$, $n = 52$, $p < .05$), the overall quality rating ($r = .54$, $n = 52$, $p < .05$). Although there were no statistically significant differences in the quality ratings for the different conditions, as described above, the correlation suggests that higher quality ratings are associated with a higher numbers of patterns used in the interfaces.

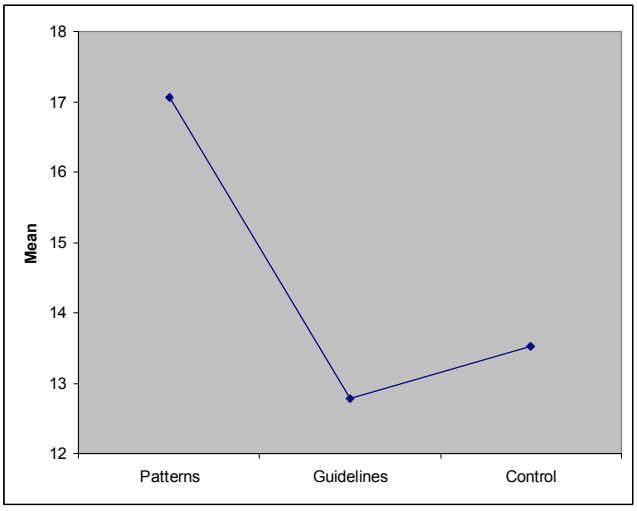


Figure 5. Means Plot for Patterns Used in Participant Designs

In summary, subjects who were exposed to a pattern language before a design task used more patterns than those who were introduced to design guidelines or those who received no intervention. But, subjects in all three conditions used patterns. It is reasonable to assume that all participants relied on the patterns they had been in contact with through their use of information retrieval systems. The use of patterns in this experimental setting was correlated with ease of use, detail, completeness, and quality.

5. EXPERIMENT 2: DO PATTERNS APPEAR IN COMMERCIAL SYSTEMS?

In an effort to establish a relationship between usability and pattern identification in the IR systems and web search engines,

two experts rated the usability of 10 systems (Table 4). Both experts are HCI researchers. They were asked to perform three tasks on each system - a general search, an advanced search, and finding the help documentation. After performing these tasks on all systems, the experts were asked to assign a subjective rating using a 7-point Likert-like agreement scale, for the overall ease of use, to each of the 10 systems. Three of the ten systems were chosen because they are some of the most frequently used search engines [10]. The other seven systems were chosen randomly from the list of the 30 systems examined in the discovery of aIRPLane.

ACM Digital Library	Ask
ComAbstracts	Emerald
Eric	Google
IEEE Xplore	MathSciNet
Wiley	Yahoo

Table 4. Systems Examined

Patterns were identified in these 10 systems by systematically examining and interacting with these systems using the same tasks that the experts performed in their evaluation. Each system was examined twice and patterns were noted independently each time. The results were then compared and discrepancies were resolved by re-examining the system.

5.1 Experiment 2: Results

Intraclass correlation was computed using SPSS. The two-way mixed model intraclass correlation coefficient was .65 indicating a moderate level of agreement. The ratings of the two evaluators were averaged and used in further analyses. In an effort to investigate the relationship between the number of patterns in the systems and the overall ease of use rating, Pearson's correlation was computed. There was a significant positive correlation between the overall ease of use rating and the number of patterns present in the IR systems and search engines ($r = .71$, $n = 10$, $p < .05$), with higher overall ease of use ratings associated with a higher number of patterns.

5.2 Experiment 2: Discussion

In summary, the aIRPLane patterns do appear in commercial IR and web search systems. The larger the number of patterns used, the higher the ease of use of a system was rated. The use of patterns in this real world setting was correlated with the ease of use rating. Whether or not designers of commercial systems are aware of the pattern language literature, they use pattern languages.

5.2.1 Are patterns used elsewhere?

At this point, we know that subjects, regardless of experimental condition, use patterns in designing systems that they are familiar with and that the use of patterns in commercial systems correlates positively with ease of use. The first conclusion indicates that the use of patterns may be ubiquitous. This prompts us to ask whether patterns are unique to architecture or interface design or whether they might be observed in other domains.

The intention of a pattern language, as described by Alexander [2],[3], was to capture the heart of successful solutions to recurring design problems in architecture and provide a common language that architects and non-architects could both use to communicate. Alexander's goal in documenting these patterns was to capture what he referred to as the *quality without a name*, a quality which made places and the people in them feel *alive and whole*. Much of the focus in HCI has been on the reuse of patterns as design tools, but patterns have also been proposed as communication tools. These claims, like most others about patterns, have not yet been evaluated.

Design often involves communication between people from many different disciplines. *Symmetry of ignorance* [46], or the problem in effectively communicating with people from different disciplines, is one of the most difficult and common problems in design. Authors in HCI, specifically Erickson [19] have discussed using pattern languages as a *lingua franca,* or a common language which allows designers and non-designers to communicate with one another. Bayle et al. [5] in a report on the results of a CHI 97 workshop point to a number of properties which pattern languages have that might enable them to serve as lingua franca for the diverse community of interaction designers including:

- they are based on concrete prototypes
- they work at multiple levels (community, group, individual) and they try to tie the levels together
- they attempt to bridge the gap between the physical and social worlds
- they are amenable to gradual development ([5], p. 18)

In discussing the communication problem that occurs in design between those from different disciplines, Borchers points out that

> If this communication fails, the result is that the methods, paradigms, and ultimately the values of each profession are not understood, and consequently cannot be respected, by the other disciplines. Any method that simplifies this mutual understanding would benefit the design process, and the resulting product ([8], p.5).

Borchers [8] also suggests that pattern languages may be a way of facilitating communication in design.

In exploring pattern languages, we, as a community, seem to have focused too much on the outcome of the design process and on reuse, when in fact we should probably be focusing on the design process itself and the communication that takes place throughout the design process. Although there has been little empirical work surrounding patterns as communication tools, there seems to be some evidence that suggests patterns may be useful communication tools. In the following section, we provide a brief review which suggests that patterns could be useful in communication.

5.2.2 The reality of patterns as communication tools

Communication is a major part of design and at times a major problem in design [8],[29],[47]. Erickson [19] describes design as a communicative process and points to the tools we use in design that aim to improve communication as evidence, for example, storytelling, scenario-making, prototype building, and user testing. In this section we review a few well-known works in design literature which address the communication process in design with the intention of illustrating how the communications described therein, are pattern-like.

5.2.2.1 Patterns as Reflective Discussion

In *Educating the Reflective Practitioner*, Schön describes a design review, essentially the reflective discussion that occurs, between an instructor, Quist, and a student, Petra, in an architectural design studio [49]. The back and forth communication that occurs between the instructor and the student in an architecture design studio seems to exhibit the essence of a pattern (problem, context, solution). Schön [49] describes a situation in which the student, Petra, shows the instructor her sketches and states the **problems** she is having.

> Petra: I am having trouble getting past the diagrammatic phase – I've written down the problems on this list. I've tried to butt the shape of the building into the contours of the land there – but the shape doesn't fit into the slope [p.46].

As the student describes her problems to the instructor, the instructor asks some questions that require a response from the student. In these questions and answers the **context** of the problem is discussed.

> Q: Is this to scale?
>
> P: Yes.
>
> Q: Okay, say we have introduced scale. But in the new setup, what about north-south?...
>
> P: This is the road coming in here, and I figured the turning circle would be somewhat here- ([49], p. 48)

The instructor and the student continue with the conversation and also create some **drawings** as they are talking. The conversation continues with the instructor exploring the consequences and implications of some proposed actions, or in other words, the **forces** at play.

> Q: Now you would give preference to that as a precinct which opens out into here and into here, and then of course, we'd have a wall – on the inside there could be a wall or steps to relate in downward. Well, that either happens here or here, and you'll have to investigate which way it should or can go. If it happens this way, the gallery is northwards – but I think the gallery might be a kind of garden – a sort of soft back area to these. The kindergarden might go over here – which might indicate that the administration over here – just sort of like what you have here – then this works slightly with the contours ([49], p. 52).

Schön describes this type of activity as "a 'what if' to be adopted in order to discover its consequences" ([49], p.57). There is clearly a similarity between what Schön is describing here and what Alexander describes as forces. The instructor and the student then seem to find a **solution**, together.

> P: Where I was hung up was with the original shape; this here makes much more sense.
>
> Q: Much more sense – so that what you have in gross terms is this…Now you have to think about the size of this middle area. You should have the administration over here.
>
> P: Well, that does sort of solve the problems I had with the administration blocking access to the gym.
>
> Q: No good – horrible, it just ruins the whole idea – but if you move it over there, it is in a better location and it opens up the space ([49], pp. 53-54).

To review, we have identified **problems**, **context**, **drawings**, **forces**, and **solutions** in the conversation that takes place between the instructor and student in a design studio. Schön provides his thoughts on what is taking place, he describes:

> What I want to propose is this: Quist has built up a repertoire of examples, images, understandings, and actions. His repertoire ranges across the design domains. It includes sites he has seen, buildings he has known, design problems he has encountered, and solutions he has devised…When a practitioner makes sense of a situation that he perceives to be unique, he sees it as something already present in his repertoire. To see *this* site as *that* one is not to subsume the first under a familiar category or rule. It is rather to see the unfamiliar situation as both similar to and different from the familiar one, without at first being able to say similar or different with respect to what…Seeing *this* situation as *that* one, a practitioner may also do in this situation as in that one…Indeed this process of *seeing-as* and *doing-as* may proceed without conscious articulation ([49], pp.66-67) (italics in original).

We would like to point out not only the obvious similarities between patterns and the conversation that is taking place in the design studio but, also the obvious similarities between patterns and what Schön is describing as being contained in the designer's repertoire.

The difference between the communication described therein and a pattern is the way in which the information is communicated. In the case of the instructor and the student, they are communicating verbally, face to face, and through drawings. In the case of interaction patterns, as we see them in HCI today, the material is documented on paper or websites so that another person can retrieve it when necessary.

If we consider the essence of a pattern, we must include a **problem** situated in a **context**, and a **solution**. In the conversation between the instructor and student, as described by Schön, we see all of these elements, as illustrated in Figure 6. Pattern-like structures are used in the reflective discussions that are common to many approaches to education.

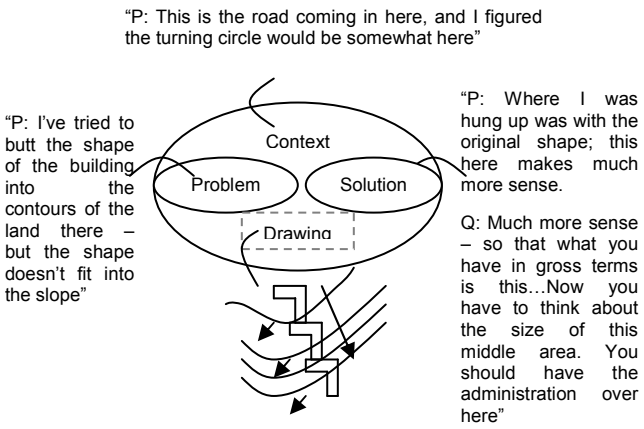


Figure 6. The Essence of a Pattern as Reflective Discussion

5.2.2.2 Patterns as Knowledge Management

In *Talking about Machines: An Ethnography of a Modern Job*, Julian Orr [44] portrays the practices of experienced and skilled photocopier technicians. Orr describes that narratives or stories, later deemed *war stories*, form a "primary element of this practice" ([44], p.2).

Orr describes that the technicians swapped war stories in a number of situations and settings and for a number of reasons, but the one thing that seems to remain constant throughout is the structure of the stories. Orr describes,

> The use of war stories is a prominent feature of diagnosis among the technicians. These stories are anecdotes of experience, told with as much of the **context** and technical detail as seems appropriate to the situation of their telling. At a minimum they name the technician doing the work, the machine to which it has been done, the **problem**, and its **solution**; in the majority of cases I observed, the technician telling the story is the one to whom it happened ([44], p.125) (bold added for emphasis).

In this description we see the main elements of a pattern: context, problem, solution. Orr describes many of the benefits of war stories that others have suggested patterns have, such as reuse and the capture and sharing of design knowledge.

> Once war stories have been told, the stories are artifacts to circulate and preserve. Through them, experience becomes reproducible and reusable. At the same time, each retelling is, in a sense a re-representation. The stories originate in problematic situations and are told or retold in diagnosis when the activity they represent becomes problematic again. They are retold in the consideration of a present problem, when the issue of comparability of context with some previous experience has arisen, and this renders the previous, completed episode once more problematic ([44], p. 126).

It is clear from this discussion that the stories circulate and that through the sharing of the stories the technicians learn from one another. Orr describes that almost everyone in the corporation knew that the technicians told war stories but, the views or attitudes towards war stories varied. For example Orr describes,

> Technicians told me that their immediate managers delayed starting team meetings because the technicians were telling each other stories about their most recent experiences, and this information exchange was perceived as useful or even vital ([44], p. 140).

Orr's study of Xerox's copier repair technicians was one factor that led to the development and use of the EUREKA system at Xerox [7]. The EUREKA system was designed over a number of years using a bottom-up participatory approach. The goal of the system was to capture and disseminate tips for repairing copiers. The tips (or pattern-like stories) consisted mainly of a **problem**, **cause**, and **solution** [7]. EUREKA has been successfully used at Xerox in France, Canada, and the United States for many years [7].

In light of the number of known failures in Knowledge Management [36] it would be helpful, for us, as a community, to closely examine how EUREKA was designed, implemented, and used. It is obvious that there is a resemblance between patterns and the EUREKA tips that contained problems, causes, and solutions. This example clearly illustrates that people do use pattern-like structures to communicate and solve problems in real world organizations.

Patterns as Comprehension Tools

Schemas, frames, and scripts are structures that have a long history in cognitive science and that, as a result, have some influence on the HCI community. Kintsch describes that *"schemas, frames, and scripts are structures used to coordinate concepts that are part of the same superstructure, or event"* ([31], p.36). Here, Kintsch is suggesting that there may be schemata for different events and stories. Van Dijk, in a more general sense, defines frames as *"knowledge representations about the 'world' which enable us to perform such basic cognitive acts as perception, action, and language comprehension"* ([60], p. 19).

As suggested above in Kintsch's definition, there are different types of schemata, including event schema, scene schema, and story schema. Mandler [37] describes each of these well. Here, we will briefly discuss story schema. Mandler describes a story schema as *"a mental structure consisting of sets of expectations about the way in which stories proceed"* ([37], p.18). Mandler continues by stating a story schema *"is a mental reflection of the regularities that the processor has discovered (or constructed) through interacting with stories"* (p. 18). This discovery or construction through interaction with stories seems to be the same way we discover and construct patterns, through experience with artifacts in our environment, for example, like our experiences with homes and interactive systems. Mandler also describes the rules for story structure,

> In the kind of relational structure that has been described, units are recognized primarily because of what has gone before (and what comes after); for example, the identical string of words could represent a beginning event, an attempt, or an outcome. The listener makes a determination of the constituent to which the sentence belongs primarily on the basis of its relation to the just preceding and immediately following sentences ([37], p. 25-26).

What Mandler describes is precisely why we have a difficult time understanding movies or stories that start at the end, because we are not aware of the right rules or structure for understanding these things. Someone that is not familiar with a particular schema or frame may find it difficult to understand a story that follows that particular schema or frame. In other words a person must understand the schema to fully understand the story. Therefore, if you do not have the appropriate schema you may not recognize that a pattern is a pattern, or understand a pattern when you see one. But, with the introduction of the appropriate schema we are able to communicate these things with one another.

Consider a thought experiment that asks European and North American participants to write a fairy tale. Suppose we gave half of the participants the schema for a canonical European/American fairy tale, and the other half were not given any structuring technique. We would not be surprised if all the stories, regardless of the group the participants were in, began with "once upon a time" and ended with "and they lived happily ever after."

On a related note, if we gave the stories the participants had written to another group of participants we would expect that they could understand each of the stories (assuming they are also from Europe or North America). But, let's suppose now that we gave half of the participants the fairy tales and the other half of the participants *War of the Ghosts,* a North American folk tale used in

Bartlett's [4] experimental studies. We would probably not expect the participants to understand the *War of the Ghosts* as well as the participants understood the fairy tale. The *War of the Ghosts* is included below.

> *One night two young men from Egulac went down to the river to hunt seals and while they were there it became foggy and calm. Then they heard war-cries, and they thought: "Maybe this is a war-party". They escaped to the shore, and hid behind a log. Now canoes came up, and they heard the noise of paddles, and saw one canoe coming up to them. There were five men in the canoe, and they said:*
>
> *"What do you think? We wish to take you along. We are going up the river to make war on the people."*
>
> *One of the young men said, "I have no arrows."*
>
> *"Arrows are in the canoe," they said.*
>
> *"I will not go along. I might be killed. My relatives do not know where I have gone. But you," he said, turning to the other, "may go with them."*
>
> *So one of the young men went, but the other returned home.*
>
> *And the warriors went on up the river to a town on the other side of Kalama. The people came down to the water and they began to fight, and many were killed. But presently the young man heard one of the warriors say, "Quick, let us go home: that Indian has been hit." Now he thought: "Oh, they are ghosts." He did not feel sick, but they said he had been shot.*
>
> *So the canoes went back to Egulac and the young man went ashore to his house and made a fire. And he told everybody and said: "Behold I accompanied the ghosts, and we went to fight. Many of our fellows were killed, and many of those who attacked us were killed. They said I was hit, and I did not feel sick."*
>
> *He told it all, and then he became quiet. When the sun rose he fell down. Something black came out of his mouth. His face became contorted. The people jumped up and cried.*
>
> *He was dead.* ([4], p.65)

As Kintsch [31] suggests, the participants would not be able to comprehend the story unless they had the appropriate schema.

Let's explore one more thought experiment here before moving on. Let's suppose we asked a group of participants to write an Alaskan Indian story, as described by Kintsch [31]. And let's suppose that we gave half of the participants the schema for an Alaskan Indian story and let's suppose the other half were given no structuring technique. It seems highly unlikely that the participants would be able to produce such a story, unless the participants had encountered the schema for an Alaskan Indian story in the past. An Alaskan Indian story, as described by Kintsch, contains four episodes which are not related in a causal-temporal way. This is very different from the schema that most of us have for a story. But, if the subjects had some past experience with Alaskan Indian story it seems reasonable to assume that they would be able to produce such a story.

In summary, we do use patterns, or schemas, which are pattern-like in communication and comprehension. We have expectations about what makes a *good* story and these expectations look very much like patterns. Patterns (or schemas) are ubiquitous and represent the design conventions that we collectively see as *good* design.

6. SUMMARY

This research was motivated by the fact that current controlled experiments show little, if any, evidence that the use of pattern languages improves the quality of interactive system designs. Still, interest in pattern languages in the HCI community remains high and studies, although they find no overwhelming advantages for pattern languages, often *suggest* that patterns have value; often, by pointing to anecdotal data.

With respect to ease of use, level of detail, completeness, and overall quality, there were no differences between subjects who used patterns, guidelines, or no experimental intervention. However, the answer to this question of whether subjects used patterns in design and whether pattern use effects quality is clearly yes. Regardless of the experimental condition, the number of patterns in subjects' designs correlated positively with overall quality of the designs, as well as completeness, level of detail, and ease of use. The use of patterns affects design quality. Further, the use of patterns is ubiquitous. All subjects, regardless of experimental condition, used patterns.

Since the use of pattern languages appears to be ubiquitous, we then looked at pattern languages in the *real world.* We looked at 10 commercial IR and web search systems and found a significant positive correlation between the number of aIRPLane patterns used in the systems and the judged ease of use. Whether they are aware of the pattern literature or not, designers of commercial systems use pattern languages.

Finally, we asked whether there were examples of patterns in design, when design is defined broadly. Taking Simon's definition of design [54] as *defining a course of action to change an existing situation into a preferred one,* it is difficult to imagine activity that cannot be classed as design!

We also found evidence of pattern-like structures already being used in communication, comprehension, problem solving, design, and other areas. While our review here is limited due to page limits, we speculate that there are similar pattern-like structures in case studies, (like those described in [1],[57],[66]), concept maps [34], case-based reasoning [1], and speech acts [51]. In summary, patterns, even though by other names, seem common.

We believe that this research shows that pattern languages are used and that they are useful. And, we believe that the fact that current controlled studies do not show significant affects is due to the fact that we are not asking the right research questions. So, where should we, as a community, go from here?

7. CONCLUSIONS AND FUTURE WORK

For more than two decades the HCI literature has focused on the promise of pattern languages [45] or the possible benefits they may provide, but there has been little empirical work to support these claims [15]. The results of this empirical study suggest that the value of pattern languages in HCI may not be in reuse, at the early stages of design, or in terms of the quality of the resulting design, when designers are familiar with the domain. The results of this study suggest that patterns are all around us.

Patterns and a pattern language for architecture were introduced by the architect Christopher Alexander et al [3] and may be the *boundary object* [55] through which diverse communities can communicate. The goal of a pattern language was to provide a language that architects and non-architects could use to describe the recurring design problems in architecture. Note that Alexander's focus was on describing common *problems* and not common *solutions.* "*Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice*" (pg. x). Patterns highlight the importance of context since each solution is crafted to satisfy the *forces* in a given *context.*

There are many reasons why the HCI design community shows a great interest in pattern languages. Erickson [19] notes that pattern languages can be the *lingua franca* to help designers and non-designers communicate. Erickson also suggests that a pattern language can help improve design quality and support reuse of solutions to common problems. Within the object-oriented software development community, patterns have been used since the early 1990s [23] and the success of the Pattern Languages of Programs (PLoP) conferences attests to the strong interest in this topic.

Clearly, patterns and pattern languages have the potential to be the *boundary objects* that can facilitate communication among the diverse group of people involved in any design effort. But, we note that while there is potential, much of that potential has not been realized. Why this is the case we will consider in the next section.

7.1 Lingua Franca or Tower of Babel?

Within the broad HCI design community, patterns and pattern languages are very popular. Many pattern collections have been proposed. But, when we consider the number of pattern collections that exist, with no obvious connection between one and another, this appears more Tower of Babel than lingua franca! For example, in an article titled Software pattern communities: Current practices and challenges, Henninger [27] reports finding over 400 user interface patterns in 14 collections!

Collections of patterns have been proposed by Tidwell [58], van Welie [62], Borchers [8] Van Duyne et al [61] and the Yahoo! Design Pattern Library [65]. This is not an exhaustive list, but only some of the collections that are often cited. Also, the number of conference, journal, and workshop papers on patterns suggests that there are many, many more collections of patterns. But, these collections do not talk with each other. Apparently, the search for a lingua franca shared by designers and non-designers overshadows the search for a lingua franca shared by different designers.

7.2 Next Steps: From Tower of Babel to Lingua Franca

The motivation for applying patterns and pattern languages in HCI design is sound and the potential benefit is great. But, how can we realize that potential? We see two areas where people engaged in research on patterns and pattern languages have yet to come to a common view.

7.2.1 Pattern collection or pattern language?

Alexander et al [2] were clear that patterns do not exist in isolation, but are part of a larger pattern language: "Each pattern sits at the center of a network of connections which connect it to certain other patterns that help to complete it. And it is the network of these connections between patterns which creates the language" (pg. 313).

A pattern language requires that there are some organizing principles that connect patterns in meaningful relationships. For example, Alexander's pattern language contains patterns for houses, neighbourhoods, towns, large cities, methods of transport between cities, and so on. Patterns are not independent of each other, but arranged in an interdependent network that forms the pattern language. In natural language, the choice of one word to add to a sentence constrains the words that can be added next. Similarly, the use of one pattern in a design constrains the additional patterns that can be used. To some extent, much of the pattern literature in the HCI design community mentions pattern languages, but the focus is much more on developing a collection of patterns than on developing a pattern language. We need a clearer focus on pattern languages.

7.2.2 Focus on solutions or on problems?

Alexander et al [3] were clear that patterns classified problems and not solutions. Consider Alexander's a place to wait pattern. This pattern applies whether you are waiting for a bus, a physician, or a business appointment. Two conditions are true of all these contexts – you must be present when the bus, physician, or business contact appears and the timing of this appearance is uncertain.

The core of the solution proposed is "In places where people end up waiting, create a situation that makes the waiting positive. Fuse the waiting with some other activity – newspaper, coffee, pool tables, horseshoes; something which draws people in who are not simply waiting. And also the opposite: make a place which can draw a person waiting into a reverie; quiet, a positive silence." (pg. 707).

Note that while the problem is common, the solution that will be effective is determined by the context in which it appears. That is, there is little, if any, reuse of a solution from one context to the next. This is an important point, but one that is missed by many proponents of patterns. For some, such as the software development community [23], reuse of solutions is a primary goal. We argue that focusing on reuse of solutions detracts from focusing on the definition of common problems and that progress in developing pattern languages hinges on agreement on the common problems.

The key to fostering communication and cooperation among diverse views of design rests on having a common view of the problems to be solved. Design researchers and design practitioners focus on different issues. For practitioners, the primary focus is rightly on design artifacts; for design researchers it is more on design process. They will see different solutions and they will each work in their own context. But, they may well be focused on the same problem.

7.2.3 Focus on artifacts or communication?

This topic is closely related to the two topics above. In this study, we observed that patterns had no apparent affect on the quality of the resulting interfaces or the time taken to design the interfaces. This result it consistent with current studies on this topic [12],[48].

We also noted a high occurrence of the patterns in aIRPLane in many popular web search engines and traditional information retrieval systems. In addition, there was a significant positive correlation between the perceived ease of use ratings and the number of patterns present in the IR systems and search engines, with higher quality ratings associated with a higher number of patterns. This is explained more fully in [64].

We suggest that the true value of pattern languages is not to aid in the design of artifacts but to aid communication among those concerned with design. In some respects, this conclusion is unique, given the current focus in the research community on design aids and reuse. But, in other respects, especially given the goal of Alexander et al [3] to provide a common language that architects and non-architects could use to communicate, this conclusion returns to the starting point of pattern languages. We note, however, that such communication also includes sharing best practices and the rationale for design decisions.

7.2.4 Where should we go from here?

We suggest a research agenda that is an extension to the research agenda suggested by Dearden & Finlay [15]. Including evaluating the contribution that patterns can have on:

- Communication (between designers and users, between interaction designers and software designers, etc.)
- The design process (particularly later iterations of a design)
- The capturing and sharing of design knowledge and design rationale

We suggest examining the impact pattern languages have on communication between people with similar and diverse backgrounds. Here we may examine the impact of a pattern language on communication, between designers and users, and between different types of designers, in terms of problems identified, specifications identified, and changes to specifications. In addition, we suggest examining when these things take place within the design process to identify whether there may be a savings in time and effort.

We suggest a shift in thinking and a shift in focus, to one which explores how patterns impact the design process and not necessarily just the products of design. In examining the design process we suggest conducting longitudinal studies which examine the impact of a pattern language on different phases throughout the design process, for example throughout multiple design and evaluation iterations. More case studies or ethnographies documenting how designers actually use pattern languages in their daily work would help further our understanding of the value of patterns languages in HCI.

We also suggest that we, as a community, focus on ways of documenting and capturing patterns so that they may be used and shared. One of Alexander's goals in documenting a pattern language was to capture what he referred to as the quality without a name, the quality present in spaces that feel whole and alive. In architecture it is not easy to define and describe quality and in HCI it is not easy to define and describe usability, but in both domains patterns and pattern languages help us describe quality and usability in a way that others can understand. Being able to describe and articulate usability through the use of patterns is surely of great value. In trying to find ways to successfully document, share, and use pattern languages we suggest the community begins by focusing on groups of designers and/or users who have an explicit need for such a thing. We suggest starting by first understanding who the users will be, what there needs are, and how they may actually use a pattern language.

We do not have all the answers for how to go about doing this. We, as a community, need to work together to address these problems. We are simply advising the community to stop spending so much energy discussing the promises that pattern languages may provide and instead focus on providing empirical support for these claims. As a community we need to shift our focus to trying to better understand the value of pattern languages in HCI. In doing this we, as a community, will then begin to see the benefits from all the great efforts in this area.

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