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Refining the Process of Sharing Problem-Solving Experience across Domain: A Hermeneutic Study

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ABSTRACT

This paper demonstrates the application of hermeneutics to studying and refining an established process. While tradition sets hermeneutic inquiry in the realms of text interpretation, its analytic features can assist in dealing with many aspects of dynamic phenomena under study, such as development processes, which can be re-cast and subsequently re-interpreted as text analogues. In our research, we specifically focus on hermeneutic emphasis of historical and factual context, on iterative development of emergent understanding of information sources, and on dealing with the prejudices and biases of both researchers and their subjects. In this paper, hermeneutics was applied to studying a process of eliciting domain experience from multimedia developers, and recording this knowledge in the form of design patterns. As a result, a well-known process of “pattern mining” was elucidated and then refined and improved through the circles of hermeneutic revisions.

Keywords

Hermeneutics, fusion of horizons, problem-solving experience, patterns, pattern mining.

INTRODUCTION

Historically hermeneutics has been known as a method for studying and understanding texts. Hermeneutic principles of interpretation have also been successfully applied in cases of analysis of text analogues, i.e. anything that can be described with text (Demeterio 2001; Kvale 1996). In information systems Boland was one of the first to apply hermeneutics and phenomenology as research methods (Myers 1997). Today hermeneutics is a proven research method in information systems and has been successfully used in various research projects, for example to design a geographic information system (Gould 1994), to investigate richness of email exchange in organizational context (Lee 1994), analyze IS projects success (Lukaitis and Cybulski 2004; Myers 1994), for understanding of information within a managerial context (Introna 1997), etc. However, very few publications clearly explain the actual hermeneutic process and its application to a particular case study. Therefore, the aim of this paper is to illustrate the adoption of hermeneutics to studying a process as a text analogue, entering a hermeneutic circle to understand and refine the process under study.

WHAT IS HERMENEUTICS?

The term “hermeneutics” originates from the Greek word *hermeneutikos* and references Hermes, the messenger god in ancient Greek mythology. In order to deliver messages he had to interpret for himself what gods wanted to communicate and then articulate those messages to mortals (Demeterio 2001). The origins of hermeneutics comes from ancient times when people wanted to understand meanings carried by religious texts, such as the Homeric epics, the Torah, the Old Testament, etc (ibid). “Hermeneutics traditionally has been defined as the theory of the interpretation of text that is difficult to understand” (Rennie 2000, p.496). The hermeneutic approach, as applied in this study, was based predominantly on the work by Hans-Georg Gadamer (1979), who emphasized the importance of self-reflection and identification of bias, and critical review of collected data and of the methods of data analysis.

One of the notions most central to Gadamerian hermeneutics is the concept of a horizon of understanding, which describes one’s vision of a phenomena. Understanding is a dynamic process and therefore “a horizon is not a rigid frontier, but something that moves with one and invites one to advance further” (Gadamer 1979, p.217). This process of understanding brings together the horizons of the original text (or text analogue) and the horizon of the interpreter which is represented as a derivative text. “In the process of understanding there takes place a real fusion of horizons...” (Gadamer 1979, p.273).

The process of understanding is iterative in its nature. Understanding of parts of an object or an event allows placing them in a larger context and thus making sense of the “whole”. The process continues in cycles by interpreting parts and their relationships and then moving to better understanding of global context and then to an improved understanding of each part. This circular interpretation continues until effective fusion of all horizons, achieving a complete understanding of the investigated phenomena (Gadamer 1979). The cycles of mutual revision of meaning between parts and whole are referred to as the hermeneutic circle. Ramberg and Gjesdal (2005) claim that the notion of “hermeneutic circle” dates back to 1670 and the work of Spinoza on understanding scriptures, whereby the understanding could be reached by movement back and forth between the parts and the whole of the text. The concept has subsequently been adopted by numerous hermeneutic philosophers and it culminated in the Gadamer's treatise on Truth and Method (Gadamer 1979).

The researcher's role is to bring together the possible horizons on the issue at hand, as well as, own horizons and pre-understanding. The interpreter's horizon depends on the local historical and practical context of the project (Fonseca and Martin 2004). Therefore, it is important for the researcher to identify possible bias, i.e. pre-judgments and expectations of understanding. Gadamer (1979) emphasized that it is natural for an individual to have prejudices as one may have past experiences with the phenomena under study and since it is impossible for a researcher to simply remove all preconceptions and presuppositions, such possible biases should be acknowledged and incorporated in the record of the observed phenomena.

PATTERN MINING AND PATTERNS

The process selected for this hermeneutic study is called pattern mining. This process supports capturing and understanding the practitioners experience in search for proven solutions to a recurring problem that arises within a certain context and driven by specific identified forces (Appleton 1997). Recurrence adds validity and certifies the quality of the solution (Corfman 1998). Captured successful problem-solving experience is recorded using a literal form called a pattern. Patterns allow practitioners to build on the experience of others who have already taken time to record this experience (ibid).

While there exist several popular formats for documenting patterns (Appleton 1997; Coplien 1996; Gamma et al. 1995), all of them commonly include a meaningful name, a clear definition of a problem, a list of situations within which a problem may be expected to occur (context), and finally a specification of the proposed solution with the consequences of its application. Patterns always identify forces causing the problem, resulting context and relationships with other patterns within the system. Often a pattern's author provides known uses of the pattern as examples illustrating the pattern's application.

A *pattern language* is a collection of interrelated patterns that together help solve problems in a given domain. It is not a language in the common sense but rather a collection of successful practices applicable to a certain situation.

The first stage of this project was to study the pattern mining process as a whole and each of its stages individually examining documents that describe them. The process as a whole is described on websites of the pattern mining community and also in various publications (Manns 2001; Rising 1999).

As a result of the documents analysis the following stages of the pattern mining process were identified:

- *Pattern crafting*, the first and early stage of pattern mining, done by an expert in the field or by a cohesive group of experts (e.g. members of the same development team).
- *Shepherding* – the iterative process where the author(s) gets advice from an experienced pattern writer (called a shepherd) in order to improve the quality of the pattern(s). The shepherd may also have some understanding of the domain to which the pattern refers.
- *Pattern evaluation* at the pattern mining workshop where experienced members of the pattern writing community share their opinions on positive aspects of the pattern and suggestions on how the pattern could be further improved.
- *Pattern improvement* based on feedback received in the previous stage *and publication*.

The first stage - crafting the first draft of a pattern or sometimes a pattern language, can be done in many ways. The most obvious and most frequently used one is based on “mining” one's own experience (Rising 1999). However, only very limited number of enthusiasts spend time and effort on formalizing their own experience into patterns. In the past Rising (1999) suggested several approaches to pattern mining where a ‘ghost-writer’ - an experienced pattern writer - was employed to assist in the pattern creation, so that the experience in the focus of the formalized pattern could still be sourced directly from practitioners. In such a process, the ‘ghost-writer’ would normally collect practical experience by means of interviews and meetings within an organization. In addition, those technically-minded practitioners, who indeed are interested in learning pattern writing, could be further assisted by attending pattern writing classes and workshops (ibid).

Stage of the pattern mining process	Pattern crafting done by authors	Shepherding guided by experienced pattern writer	Pattern evaluation in the workshop	Pattern improvement done by authors
Domain knowledge	Compulsory	Optional	Optional	Compulsory
Pattern writing skills	Compulsory	Compulsory	Compulsory	Compulsory

Table 1. Distribution of domain knowledge and pattern writing skills across various stages of pattern mining.

After analyzing the involvement of domain practitioners in various stages of pattern mining (see Table 1) it was concluded that the current pattern mining process has several deficiencies, namely:

- Produced patterns and pattern languages often reflect opinions of a relatively small and most likely cohesive group of people, who may not even represent the best domain practice. As summarized in Table 1, pattern writing skills are contributing to every stage of the pattern mining process, whereas domain expertise may be limited to pattern authors' knowledge only. Therefore there is room for improvement – other practitioners may be able to enrich patterns.
- Shepherding and evaluation relies on active participation of pattern writers – quite often there are no domain experts among them and evaluators of the pattern have only superficial knowledge of the field.
- To participate, a practitioner has to learn pattern writing and become a patterns' author – it is time consuming and not everyone is interested.

In this study we decided to focus on the first stage of the pattern mining process, i.e. pattern crafting in which patterns originate and which can greatly benefit from wider involvement of practitioners. In fact, this very idea of capturing best development practice into design patterns, with or without practitioners' active cooperation, provided us with some strong motivation for investigating pattern mining from the vantage point of an entire problem domain rather than as currently practiced across a single team or organization. As the domain-wide pattern mining is a novel undertaking, we have therefore set forth this research project to propose and then iteratively improve such a process.

APPLICATION OF HERMENEUTICS TO THIS PROJECT

By recording best practices as patterns other practitioners can share their knowledge. Here Gadamer's "fusion of horizons" describes the dynamic process occurring during experience sharing. The pattern mining process can be considered hermeneutically as an articulation of the relationship between domain practitioners' personal and socially determined pre-understanding of their practice, and the views of pattern miners on the methods of capturing problem-solving experience. The resulting patterns can be further refined by other practitioners, shepherds and workshop participants to match their pre-understandings of their practice. So the pattern mining process in itself is a specific form of the hermeneutic circle. Thus, the hermeneutic approach is eminently suitable for this study, which already displays many hermeneutic characteristics which are summarized in Table 2.

The multimedia domain was selected because it has been fast developing, while suffering from multiple technological and non-technological problems. It has not been well-covered by pattern mining activities although it has good potential in presenting and sharing problem-solving experience in pattern format. However, due to this domain extensiveness we limited our interest to the front-end multimedia development.

While examining the pattern mining process both researchers developed their horizon of understanding of the process and its deficiencies. However, in accordance with one of the principles of hermeneutic study – the principle of contextualisation (Klein and Myers 1999) – there was also a need to understand the domain under study and to identify areas of practitioners' concerns. Understanding of the phenomena can be done using various approaches including interviewing, observation, focus groups. For domain understanding taking an interview approach allowed targeting individual subjects from a variety of backgrounds and with a different work scope. In an interview environment it was possible to gather each subject's personal views and experiences in the context of the projects they have worked on or recently completed. Therefore the horizon of understanding of each individual participant was discovered and this horizon was explored in the context and historicity of the described projects. At the same time hermeneutics is "doubly relevant to interview research, first by elucidating the dialogue producing the interview texts to be interpreted, and then by clarifying the subsequent process of interpreting the interview texts produced..." (Kvale 1996, p.46).

Hermeneutic feature	Application to this research
<i>Text</i>	We are studying the pattern crafting process and its outcome which both can be represented with their textual descriptions – the text analogues of the artifacts under investigation.
<i>Historicity and context</i>	The identified issues of importance to practitioners have to be studied in the wider context of undertaken projects, conducted at a given point of time, in a particular location and for a specific client.
<i>Hermeneutic circle</i>	As the domain knowledge and practice are broad and not well understood (by researchers) at the time of conducting the study, we therefore aimed at iterative refinement (by means of several cycles) of our understanding of the domain issues and process-related phenomena across the application domain.
<i>Horizons of understanding</i>	The meaning provided by individual domain experts will have to be gradually captured, interpreted and represented in a pattern format, thus necessitating “fusion of horizons” from multiple perspectives.
<i>Bias</i>	Having previous pattern mining and crafting experience and being intimately involved in this research, we had to identify our own preconceptions and biases and control them in each hermeneutic cycle. At the same time, we also dealt with the biases of our subjects.

Table 2. Hermeneutic features exhibited by this study

It was important to consider practitioners with different work scope to meet the theoretical sampling requirement (Strauss and Corbin 1998) where participants were to be represented by the range of views and experiences. Harmer (2003) indicated the importance of providing evidence from multiple sources of data. Since hermeneutics focuses on understanding of textual descriptions, it does not prescribe the minimal number of sources, however researchers applying hermeneutics to IS projects in the past used as few as four (4) participants (Lee 1994). In our study, in order to identify common experience across the studied domain, seven (7) participants with various work scope were interviewed to achieve theoretical saturation (Strauss and Corbin 1998). Among participants were web developers, graphic designers, multimedia designers, etc. Analysis of transcribed interviews led to discovery of individual participants’ horizons of understanding, which were then explored in the context and historicity of their respective projects (as reflected by the interviewees), and which eventually merged to reflect on the common experience across the entire domain. This data analysis was also used as foundations for building the researchers’ horizon.

The task of analysing collected data and producing pattern skeletons and later full patterns was done by the ghost-writer, a person collecting experience from practitioners and presenting the body of experience in the format of patterns and pattern languages. In a typical situation a ghost-writer is an experienced pattern writer with some experience in the domain under investigation. Cole and O’Keefe (2002) emphasize that although in IS the traditional attitude is to condemn the researcher being too closely involved with the subjects, for the hermeneutic study it could be quite the opposite, i.e. could strengthen the study since close interaction with the subjects would support inducing contextual meanings. Being hermeneutic researchers we were looking for direct insights in the process under study and the fact that one of us took on the role of a ghost-writer supported intimate involvement with the procedure and provided conditions for obtaining deep insights into the studied phenomena in the spirit of interpretive research (Klein and Myers 1999; Shanks 1996).

The preliminary understanding of the pattern mining process led us to a list of tasks that had to be completed in this research. However, it was not clear upfront at which points in the hermeneutic circle they were to be undertaken and how many cycles (Cole and O’Keefe 2002) were necessary to achieve (via theoretical saturation) the goals of this study. In every hermeneutic cycle we continually re-assessed our own biases. Our knowledge contribution to the process was restricted to pattern writing skills, which was fully consistent with the role of the ghost-writer.

The empirical work demonstrated that four hermeneutic cycles were sufficient to understand and refine the currently employed pattern crafting process. As part of that process we also produced patterns capturing some problem-solving experience in the multimedia domain. In each of these cycles we produced derivative texts reflecting the researchers’ horizon of understanding as well as the horizons of pattern writers and domain experts. The hermeneutic process was enacted by iteratively examining new insights that were subsequently contributing to the whole understanding, which in turn was forcing the enquirer to re-evaluate the previously acquired insights in the context of the newly developed horizon of understanding.

1. As described in the “Pattern Mining and Patterns” section of this paper the first cycle was devoted to studying and understanding the currently used pattern mining process with the focus on its first stage – pattern crafting. In this cycle the

researchers' horizon of understanding was broadened and deficiencies of the current process were identified. These deficiencies reflect our findings in this hermeneutic cycle.

2. The second cycle aimed at domain understanding. The transcribed interviews with domain practitioners provided the text to study. The resulting system of codes reflecting practitioners' concerns was the derivative text representing the researcher's horizon of domain understanding.
3. In the third cycle an approach to categorizing collected data was discovered. The researchers interpreted original interviews texts as well as the system of codes developed in the previous cycle. The proposed way of categorization allowed producing outlines of pattern languages and pattern skeletons with large gaps, a rich derivative text reflecting important problems in the multimedia domain and displaying the fusion of horizons of the researchers, domain practitioners and the ghost-writer.
4. The fourth and last cycle of this study aimed at investigating the feasibility of producing full patterns in the focus group session involving domain practitioners and experienced pattern writers. The text for interpretation was a pattern skeleton that was interpreted by focus group participants. The resulting pattern was a derivative text showing full fusion of horizons of the domain practitioners, the ghost-writer and pattern writers.

To comply with the hermeneutic principles, we had to identify and control our own biases and prejudices while analyzing the collected domain insights and making sure that we contributed only some pattern writing skills.

Since reflections on the first cycle were reported in the "Pattern Mining and Patterns" section of this paper we proceed from the second cycle.

Domain Understanding

In this round of hermeneutic analysis, empirical data as related to the practitioners' multimedia development experience, issues and concerns have been collected and analyzed.

Seven practitioners were interviewed. They were asked to demonstrate the project of their choice, while reflecting on the design process, different drafts, problems and decisions, and best practices. We derived text analogue from interview data and then applied hermeneutics to it.

In order to find common issues of concern this study needed to develop an approach supporting systematic analysis of domain data. In the past categorization and themes recognition have been applied in hermeneutic studies (De Vries and Miller 1987; Standing and Standing 1999). Finding common themes via coding has been widely used in data analysis of various research methods. For example, open coding applied in grounded theory (Strauss and Corbin 1998), supported such categorization of data and was applied in this research for identification of typical issues and problems being solved by practitioners.

A range of topics covered in interviews was very broad and the initial coding approach taken was very fine-grain with unique codes developed for each design issue of interest to the researchers. The reason for such an approach was an attempt to reflect unique projects' context and historicity through codes. The resulting system of codes was quite voluminous, very comprehensive in its domain coverage, insightful as to the design issues of pertinence to multimedia practitioners, and at the same time quite cumbersome for further analysis.

Reflections and Findings

The hermeneutic analysis of the outcomes resulting from the coding process showed some clear benefits of the adopted fine-grain approach. We could identify design issues and areas in the multimedia development process that were important to practitioners. The developed rich textual system of codes reflected both the historicity and the context of projects and represented expansion of the researchers' horizon and its gradual fusion with practitioners' horizons.

At this point in time, we also became aware that in this round of analysis we gained rich understanding of the multimedia domain which had the potential to influence our subsequent work. We recognized it as a threat of possible bias which had to be controlled, especially at the time of producing patterns.

Extracting Pattern Languages and Pattern Skeletons

In this cycle we worked on the original text from the previous cycle and also on the derivative text of rich system of fine-grain codes created in the previous hermeneutic cycle. Since the data coding approach useful for domain understanding was not suitable for the purpose of extracting pattern languages and pattern skeletons from data, the new coding scheme was built

upon the existing fine-grain codes. While re-reading the codes and coded sections of data we analyzed them to identify common issues, concerns and problems. For example, in the previous cycle six unique codes were developed for quotes referring to business aspects of color schemes. However, at a higher level of abstraction all these codes were referring to the same issue – how pre-existing business context influences selection of the color scheme for a Web site. As a result practitioners’ experiences were generalized and joined into categories. Broad categories, such as “Color scheme design”, “Menu design”, “Laying out information”, “Addressing accessibility issues”, etc., were discovered (see Figure 1). The interviewees brought up important problems common to most of the projects (see Table 4), illustrating fusion of horizons of domain practitioners.

Some categories had specific aspects associated with them. For example (see Table 3), for the “Color scheme design” task issues such as “Business”, “Perceptual”, and “Technical” were identified. For each of these task-related issues we also recorded other design aspects which we found were commonly considered by multimedia developers. As a result we discovered that the first coding step should be done by categories corresponding to design tasks and their aspects.

As the intense analysis within each category (i.e. design task) was performed, the analysis process gradually transferred into the next stage – *coding within categories* which aimed at discovering pattern skeletons. Therefore the coding system used pattern sections according to the adopted pattern format, i.e. problem, solution, forces, context and consequences. Although full patterns were not induced, it was possible to extract pattern skeletons with large gaps. It was clear that filling the gaps in the pattern skeletons would require more data collection in the future hermeneutic cycles. Since our horizon of understanding the problem-solving experience in the domain was just developing we did not modify any of the subjects’ statements when placing them in pattern skeletons. We were cautious with our interpretation of the data.

Reflections and Findings

In this hermeneutic circle, our most important finding was that it is indeed possible to analyze the semi-structured interviews with a view to identify important multimedia design issues and to cast these into an outline of a pattern language and selected pattern skeletons. These design issues giving the outline of the pattern language were discovered through coding by categories

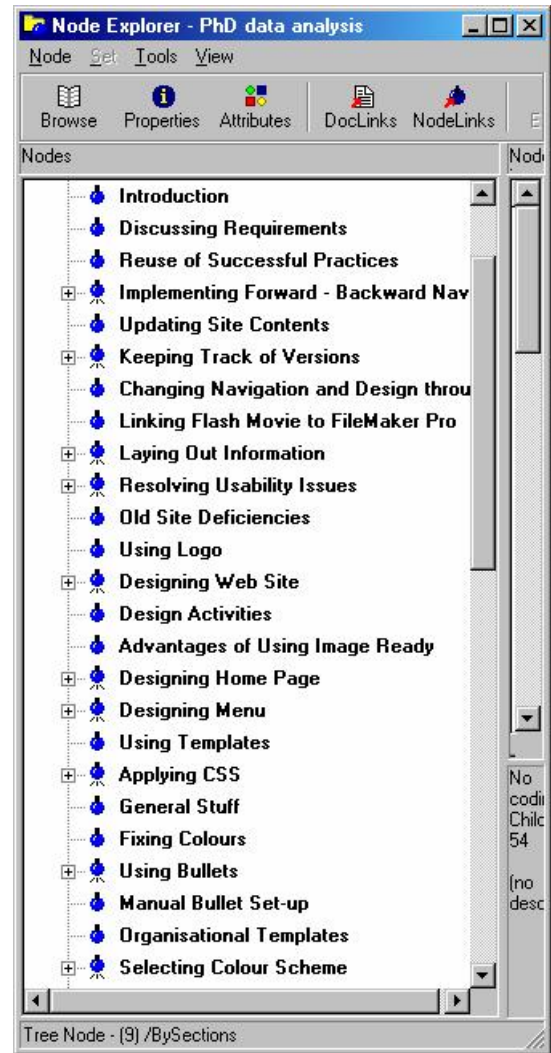


Figure 1. Codes reflecting design issues

where categories reflected design tasks and their aspects. The outcome of the coding within categories resulted in discovering patterns’ sections (problem, context, forces, etc), thus producing skeletons with gaps to be filled in during follow-up procedures involving practitioners. These gaps were very large, e.g. a pattern skeleton could have partial context and solution but no forces, consequences, etc. This information was not available from the first round of interviews since the aim at a time was to identify issues of importance to practitioners rather than comprehensive probing of all problem-related aspects.

The resulting patterns skeletons and pattern language outlines illustrate further fusion of horizons of the ghost-writer and practitioners in understanding of the problem-solving experience of the multimedia domain.

Design issues	Aspects of design tasks to be considered
Business issues	<ul style="list-style-type: none"> • Business colors on a Web site • Colors coming from industry
Perceptual issues	<ul style="list-style-type: none"> • Traditional acceptance of blue and white • Offsetting one color with another • Offsetting bright colors with neutral areas • Subjective perception of colors and color schemes • Introducing “surprise” colors • Readability of text heavy Web pages
Technical issues	<ul style="list-style-type: none"> • Predictable palette • Editing software color tables

Table 3. Possible pattern language outline for the “Color scheme design” task

Design Tasks	WD1	WD2	WD3	GD1	GD2	GD3	MMP1
Selecting a colour scheme		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Usability issues (screen size, browsers and their versions)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Menu design	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Software applicability for design tasks	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
Laying out information / Use of templates	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Selecting fonts		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		
Addressing accessibility issues		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>			
Representing timeline						<input checked="" type="checkbox"/>	
Working with digital images		<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
Composing a movie							<input checked="" type="checkbox"/>
Communication with the database	<input checked="" type="checkbox"/>						<input checked="" type="checkbox"/>
Updating site contents by the client	<input checked="" type="checkbox"/>						

Table 4. Common issues of concern for practitioners (WD – web developer, GD – graphic designer, MMP – multimedia producer)

However, large gaps also indicate that it was only partial fusion and therefore there was an obvious need for more cycles to be conducted to achieve complete understanding of the problem-solving experience.

Since fine-grain codes were merged into groups representing major areas of practitioners' concerns, it gave us grounds to conclude that application of hermeneutics to the textual representation of interviews should be done within identified areas of concern. The design-tasks based system of codes developed in this cycle represented the derivative text illustrating further fusion of horizons of practitioners and the ghost-writer. This system of codes can be re-applied when more domain experience is collected for the purpose of enriching existing patterns and producing new patterns.

Yet again, there was some bias in the coding and patterns creation due to our implicit role of 'ghost-writers' as assumed in the pattern mining process. As a result, the classification of practitioners' statements into elements of design patterns was based in its entirety on our subjective decision and the associated coding system.

Producing Patterns in the Focus Group

The purpose of this cycle was to actively involve professional multimedia developers and pattern experts to refine the domain knowledge representing it in the pattern format by filling the gaps in patterns skeletons. It was expected that merging horizons of multimedia practitioners and pattern writing experts would contribute to pattern crafting process understanding and refinement.

The participants of the focus group included two multimedia practitioners and two pattern-writers with some background in multimedia. One of us moderated the session. The participant's handout included brief explanation of what patterns are, the pattern format to be used, the issue under investigation – crafting of patterns by collecting experience across domain and pattern skeletons containing quotes from the interviews covering the topic "Business Type and Pre-existing Context as Influence on Web Site Design". The participants' task was to examine practitioners concerns related to the specified topic and to attempt producing patterns based on our draft generated from interviews analysis and participants' own experience. The role of practitioners was to provide missing domain information whereas the task of pattern experts was to structure it according to pattern-writing guidelines.

Only one pattern was produced as a result of this session. However, participants in their discussion pointed out opportunities for more patterns to emerge.

Reflections and Findings

The important finding was that by bringing together multimedia domain knowledge and pattern writing skills it is possible cast domain experience into full patterns by refining semi-structured problem-solving experience and adding quality to it. These patterns represent text analogue of domain understanding and reflect the fusion of horizons of domain practitioners and pattern writers.

Coding by categories (i.e. design tasks) proved to be very useful for discovering problems and clustering designer concerns: it places all quotes from different sources relating to the same issue together for further analysis. However, coding by categories may be subjective. In this focus group the participants decided that some statements should be moved to a separate pattern, therefore it raises the question that possibly some data that was not shown to the focus group could be relevant to this discussion. The conclusion from this observation is that *misclassification during open coding cannot be avoided* if the open coding is carried out by one person only. It reflects the horizon of understanding of the ghost-writer, performing the coding. At the same time due to large gaps coding within categories was completely ignored and therefore we decided that this step is not necessary in the refined process.

Multimedia designers participating in the session obtain pattern-mining skills. Active knowledge exchange through discussion took place. The session demonstrated the process of building a horizon of understanding of pattern crafting for domain experts as well as fusion of horizons for people with different backgrounds, i.e. domain experts and pattern writers.

Such a focus group reproduces a pattern-mining mini-workshop. The bias of the ghost-writer that influenced participants' handout material was neutralized. Through the heated discussion the participants' bias was reduced and the resulting pattern was not a single person opinion.

DISCUSSION OF FINDINGS

In the centre of this study was application of hermeneutics to understanding and refinement of the pattern mining process. The discovered process can be characterized by the following workflow (see Figure 2):

- A ghost-writer collects practitioners' stories via interviews and "think-aloud" observations.
- A ghost-writer applies open coding to categorize concerns around design tasks performed by practitioners. The outcome consists of pattern languages outlines and categorized excerpts of problem-solving experience.
- A category of concerns is presented to a group of domain practitioner and experienced pattern writers for pattern crafting under the guidance of an experienced ghost-writer.

The refined process eliminates deficiencies identified in the first hermeneutic cycle. Table 5 illustrates how the two processes (currently used and proposed) compare on each of the four deficiencies.

On the first issue of mining experience across the domain the proposed process includes the formal procedure leading towards discovery of patterns and pattern languages based on collecting experience from multiple sources in the domain. The current process relies on expertise of a single person or a small team of people willing to mine patterns together.

In the second issue practitioner's participation is considered active if the practitioner possesses pattern writing skills or passive, i.e. the practitioner shares the experience in any format and a ghost writer converts it to the pattern format. The current process supports only active participation of practitioners whereas the proposed process allows experience mining

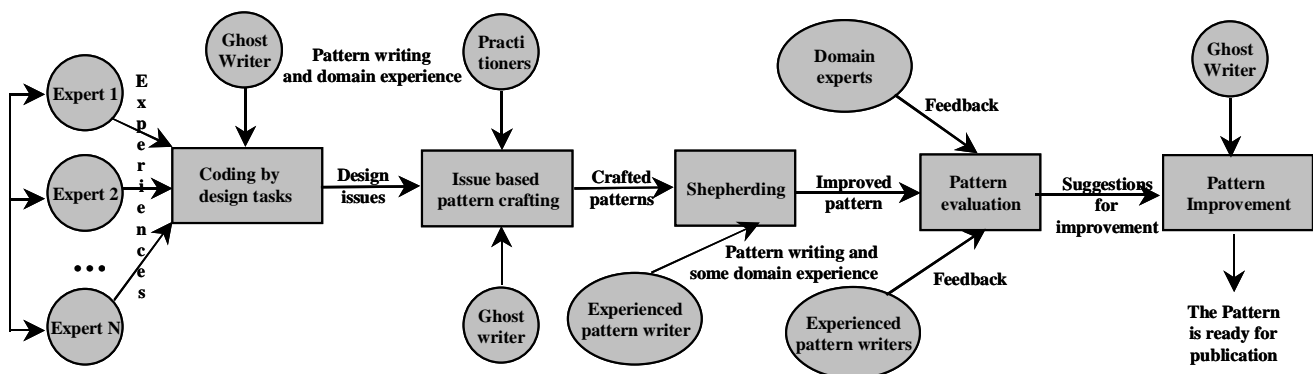


Figure 2. Refined pattern mining process

Deficiency/Issue	Scope	Practitioners' participation	Pattern writing skills for practitioners	Away from the Workplace
<i>Current</i>	Single or cohesive team	Active	Necessary	Yes
<i>Refined</i>	Domain-wide	Passive or Active	Optional	Not necessary

Table 5. Comparing the pattern mining processes against identified deficiencies

from any domain expert willing to contribute their expertise, which also addresses the third issue allowing practitioners to gain pattern writing skills if they wish, whereas in the current process there is no procedure in place to involve practitioners who are not familiar with patterns.

Finally the fourth issue indicates that practitioners' non-participation in knowledge sharing may be caused by necessity to be taken away from their workplace. Again the current process leaves out such experts whereas the proposed process allows customizing expertise gathering procedure in order to accommodate the needs of participating practitioners.

The outcome of the typical pattern mining process is a set of patterns or a pattern language. The result of this study produced a much richer outcome. Apart from the refined pattern mining process we induced outlines of pattern languages, pattern skeletons and full patterns that were based on a domain-wide experience. We also developed a reusable system of codes for the multimedia domain that can be applied to data when researchers or ghost-writers follow the suggested process to capture problem-solving experience and represent it in the pattern format.

The issues treated by our research thus spanned four dimensions.

- *A domain-specific problem-solving experience*, which we have identified, coded and analysed, and which also provided the context for refining the pattern mining process;
- *Pattern crafting process*, which we have proposed, iteratively refined and then formalised;
- *Patterns and pattern languages*, which we have developed for the domain under study;
- *Our own prejudices and biases*, which we have formally identified and then dealt with to minimize their interference with the carried out research.

These dimensions represent our hermeneutically derived horizon of understanding, which has resulted by iteratively fusing horizons of domain practitioners, pattern writers, ghost writers and researchers.

CONCLUSION

In this paper we demonstrated the application of hermeneutics to studying and refining the process of pattern mining, widely used by the pattern community. The currently employed process has some deficiencies, especially in its earliest stage – pattern crafting. We entered a hermeneutic circle with a goal of understanding the multimedia domain and developing a formal approach to pattern crafting in this domain that would allow producing shareable and reusable nuggets of multimedia domain experience. By applying hermeneutic interpretation to problem-solving experience conveyed by practitioners (our original text) we obtained patterns and pattern languages for multimedia domain which represented fusion of horizons of practitioners and pattern writers.

We developed the improved formalised approach to pattern crafting which supports wider involvement of practitioners across a domain into sharing their problem-solving experience. We also developed a method for application of coding strategies to analyse best practices in multimedia domain.

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