

# Developing Patterns Step-by-Step

## A Pattern Generation Guidance for HCI Researchers

Alina Krischkowsky, Daniela Wurhofer, Nicole Perterer, Manfred Tscheligi

Christian Doppler Laboratory for “Contextual Interfaces”  
HCI & Usability Unit, ICT&S Center, University of Salzburg  
Salzburg, Austria  
{firstname.lastname}@sbg.ac.at

**Abstract**—Despite the broad application and usefulness of patterns in many application areas, there is still a lack of information on how patterns are generated. In this paper, we introduce a step-by-step guidance for generating patterns in the domain of human-computer interaction (HCI). With our guidance, we support researchers in structuring and presenting gathered empirical knowledge for special contexts (automotive, home, mobile). By means of the pattern generation guidance, we support researchers without previous expertise in pattern generation to make their insights available for other HCI researchers. Furthermore, our approach enhances the pattern generation process towards more traceable and comparable patterns.

**Keywords**—Pattern Development; Guidance; CUX Patterns

### I. INTRODUCTION AND MOTIVATION

Patterns have turned out to be a valuable tool for structuring and capturing knowledge in many application areas. For example, patterns are used in architecture, software engineering, interface design, pedagogics or ubiquitous computing (e.g., [1], [2], [3], [4], [5], [6]). In these contexts, patterns have been applied to document proven solutions for reoccurring problems in a specific domain. In the field of human-computer interaction (HCI), patterns have been used for documenting results from empirical studies (see e.g., [7][8]). As patterns allow to structure and collect study results in a systematic manner, the gained knowledge can be easily and quickly provided to other researchers and stakeholders.

Despite the broad application and apparent usefulness of patterns in general, there is still a lack of information on how patterns are generated. In fact, pattern generation seems to be more a matter of experience than of a structured process. In the pattern community, there is little literature available that tells more about the genesis of patterns. It still remains unclear how patterns actually come into existence and how patterns should be generated [7]. This makes it especially difficult for novices, who have no previous experience in developing patterns. In the area of HCI particularly, it turned out that patterns are a valuable tool to systematically structure and collect knowledge from empirical studies. There is a need for supporting researchers in developing patterns. Research in this area - i.e., how to come from

empirical findings to patterns - is rare. There are some first attempts dealing with the generation of patterns; however, we did not find systematic descriptions of the generation process. Thus, the process of pattern generation can be considered as implicit knowledge – knowledge that is based on one’s expertise or experience and often hard to articulate. This is not only difficult for researchers who are unfamiliar with pattern generation but also poses the problem of traceability and comparability. To the best of our knowledge, a systematic guidance for developing patterns based on empirical study results does not exist to date.

This prevalent deficiency encouraged us to develop a step-by-step online guidance for pattern generation in the area of HCI. In particular, we intended to support User Experience (UX) researchers in converting their gathered knowledge from empirical studies into patterns. The structural foundation for the intended patterns is the so-called Contextual User Experience (CUX) patterns format [9]. CUX patterns provide solutions on how to improve a user’s experience when interacting with an interface in a specific application area. They are characterized by explicitly combining contextual aspects and UX.

The objective of this paper is to introduce a step-by-step UX pattern generation guidance. After motivating the need for systematic pattern generation guidance in Section I, we give an overview on patterns in HCI as well as on existing pattern development approaches in Section II. Based on a critical examination of existing pattern development approaches, we then present in Section III, our attempt to guide researchers in the pattern generation process. In Section IV, we provide insights on how we employed the suggested pattern guidance in a first pre-test in order to gather suggestions for further improvements and iterations. Based on related work done in this area, our proposed step-by-step guidance as well as the insights gathered within our first employment, we then, in Section V reflect and discuss our actions taken and provide an outlook for future work.

### II. RELATED WORK

#### A. The Role of Patterns in HCI

In HCI, patterns have gained a lot of attention over the last years. Especially in interface or interaction design, there

are numerous pattern collections (e.g., [10], [11], [4]). The concept of patterns in this area is known under different names; e.g., ‘interaction (design) patterns’, ‘user interface (UI) patterns’, ‘usability patterns’, ‘web design patterns’, ‘workflow patterns’ or, more general, ‘HCI patterns’. Basically, these patterns provide solutions to commonly occurring usability problems in interaction and interface design. As the comprehensive use of patterns shows, patterns have been proven as a valuable tool for designing usable systems.

Apart from dealing with common user interface or interaction problems, patterns have been also used to document knowledge based on empirical studies. Martin et al. [7] developed patterns for cooperative interaction in order to organize, present, and represent material from ethnographic studies. In their work, patterns primarily served as a vehicle for presenting the major findings of previous studies and as communicative devices. In contrast to interface or interaction design patterns, this approach does not deal with solution-orientated patterns but rather with descriptive patterns in the tradition of Erickson [12]. UX research represents another specific domain of HCI, where patterns have been deployed to collect and structure knowledge based on empirical findings [8]. In the following section, we will introduce the idea of UX patterns in more detail as this represents the basis for the patterns generated with our pattern generation tool.

### B. UX and Patterns

One major aim of HCI research is to create a positive experience while interacting with an interface [13], [14]. Research in this area is often referred to as “UX research”. According to Alben [15], UX comprises all aspects of how people use an interactive product. This means, all the aspects of how people use an interactive product: the way it feels in their hands, how well they understand how it works, how they feel about it while they are using it, how well it serves their purposes, and how well it fits into the entire context in which they are using it [15]. Patterns have already been applied in the area of UX in order to structure and preserve knowledge. Blackwell & Fincher [16] suggest to adopt the idea of patterns and UX in the form of Patterns of User Experience (PUX). Such patterns should help HCI professionals to understand what kind of experiences people have with information structures.

Obrist et al. [8] applied UX patterns to document knowledge on UX in the domain of audio-visual networked applications (e.g., Facebook or YouTube). By means of UX patterns, they intended to capture the essence of a successful solution to a recurring UX related problem or demand of audio-visual networked applications. They developed a set of 30 UX patterns, summarizing the most important insights based on qualitative and quantitative studies. Thus, empirically grounded guidance on how to design for a better UX in audio-visual networked applications is provided. An extension of the UX patterns, are the so-called Contextual User Experience (CUX) patterns [9]. This approach relates

contextual issues to UX and provides a pre-defined pattern structure to do so. Accordingly, patterns are “used to describe knowledge on how to influence the user’s experience in a positive way by taking context parameters during the interaction with a system into account.”

### C. Approaches on Pattern Generation

As already stated before, there is not much literature on how to generate patterns. The process of looking for patterns is often considered as pattern mining [10]. However, pattern collections or languages are often introduced without explicitly stating how the patterns emerged. One of the few outlining their experiences and difficulties in developing patterns were Martin et al. [7], who deployed patterns for describing insights from ethnographic studies. They started pattern creation by looking, for instance, of repeated phenomena in ethnographic studies (re-examination of previous studies). Thereby, they included a reference to their context of production and seeking in their pattern descriptions. For them, the main purpose of patterns was to present major findings of previous studies and as communicative devices. For their creation of patterns, they began with looking for specific examples in a particular domain and then tried to expand the observed phenomena to other domains (similar but different examples).

In his work, Vlissides [17] describes seven habits for successful pattern writers. According to the author, reflection is the most important activity in pattern writing; this should be done by thinking about the developed applications and the problems and (if existing) successful solutions. This will provide the raw material of patterns. Additionally, similar applications or domains with similar problems can also give support for problems and solutions and, therefore, for the development of a pattern.

According to the author [17], the next step will be to choose a suitable and consistent structure for the patterns to be developed. Another important point in the development process of pattern is concreteness (compared to abstractness), meaning that concreteness improves the comprehensibility for people. It is also crucial to always keep the intents of patterns in mind, as well as the relationships between the patterns, so that the details of the patterns do not prevail. Moreover, effective presentation of patterns, including typesetting and writing style, is substantial for the quality of patterns. It is also important to mention that continuous iteration is essential, as patterns are never completed and always can be improved. Re-writing patterns, is therefore, a “normal” and necessary process. Finally, the collection and incorporation of feedback is another important step in the development of patterns. This includes the fact that patterns should be understandable to people, who had never been concerned with the problem before.

In order to develop patterns, Christopher Alexander defined the following questions to be answered within the process of mining [1].

- 1) “What, exactly, is this something? We must define some physical feature of the place, which seems worth abstracting.
- 2) What, exactly, is this something helping to make the place alive? Next, we must define the problem, or the field of forces, which this pattern brings into balance.
- 3) And when, or where, exactly, will this pattern work? Finally, we must define the range of contexts where this system of forces exists and where this pattern of physical relationship will indeed actually bring it into balance.”

Alexander already pointed out the difficulty of generating patterns: “One very important question in writing patterns is, of how someone can recognize a pattern when coming across one? A simple but precise answer to this question is, that someone cannot always know.”

According to Appleton [18], the best way to learn how to recognize and document useful patterns is by learning from others how they have done it well. It might be a good idea to read several books and articles that describe patterns and then try to see the necessary pattern elements and desirable qualities of a pattern. It has to be highlighted, that it is important to be introspective about everything to read. However, this is again about implicit knowledge and does not make the process of generating patterns explicit. There exist different criteria, which should be met by patterns in order to be considered as “good” patterns [18]. Further, there are defined processes a pattern should undergo [19]: (1) pattern mining, (2) pattern writing, (3) shepherding, (4) writers workshop, (5) author review, (6) pattern repository, (7) anonymous peer review, and (8) pattern book publication. However, there are no specific descriptions of each process in detail, and it is still not explicitly described how a first version of a pattern is developed.

#### D. Pattern Generation as Implicit Knowledge

According to May and Taylor [20], knowledge cannot always be handled directly. Knowledge emerges from a combination of expertise, perception, personal skill, and history, as well as constructive memory [21]. Indeed, some gathered information might be rather implicit and needs to be transferred into explicit knowledge. Thus, alternatives to capture and manage information in a way that supports making knowledge explicit and transferable are necessary. In order to capture and manage information to make knowledge more explicit, they suggest the use of patterns. Based on this, we see that the process of pattern generation can be considered as tacit or implicit knowledge – knowledge that is largely based on one’s experience and hold by experts in patterns and pattern development [20].

It is quite common, that experts are unable to explain their methods or rationalize their actions. So far, the process of pattern generation is hardly explained in detail or described explicitly. In order to allow also non-experts to generate patterns, we aim to convert the implicit knowledge on pattern generation into an explicit one by applying our step-by-step pattern generation guidance. In this paper, we

present a step-by-step pattern generation guidance whereby more details on our guidance are outlined below.

### III. A STEP-BY-STEP PATTERN GENERATION GUIDANCE

Within our research activities, the need for pattern guidance occurred within two national projects. These two projects focus on interface research. One project especially takes into account UX in the automotive context, whereas the other project deals with advanced interfaces in the home and mobile context. In both projects we aim to preserve knowledge gained on UX and contextual aspects based on empirical studies. Therefore, we used the CUX patterns approach [9], which has already proved its value for collecting and structuring knowledge on UX [8]. In comparison to other pattern structures, the CUX patterns approach seemed as most appropriate as it explicitly considers the relation of UX and contextual aspects. As this is an objective of our research, we chose the CUX pattern structure as a tool for preserving our knowledge.

Confronted with the fact that researchers involved in these projects were domain experts but mainly novices with regard to pattern generation, we systematically scanned literature in order to find advice for non-pattern experts on how to develop patterns. As already pointed out in our related work part, the main problem we identified was that the process of pattern generation represents implicit/tacit knowledge (i.e. expert knowledge). In order to make this knowledge also usable for non-experts, it has to be made explicit. According to our knowledge, this has not been done so far in a systematic manner. Thus, our step-by-step guidance on pattern generation represents a first step towards making the process of pattern generation explicit, allowing non-experts also to generate patterns and making the pattern generation process itself more traceable.

In the following section, we outline our developed pattern generation guidance in detail, reflecting on each step individually. Our major goal was to develop a systematic process that supports researchers to create patterns out of empirical study results. In order to ensure that the researchers have the possibility to iteratively as well as remotely, succeed with the pattern generation guidance, we set up an online survey (see for tool specific details [25]). Further, the use of this online survey tool supports storing data in a database, resulting in a pattern at the end.

After conducting intense desktop research, we developed an initial suggestion of a structured pattern generation guidance to support HCI researchers to create their own CUX pattern out of empirical study results. Our guidance is divided into five steps, all described in detail below.

#### A. Step I: Introduction on Patterns

Within this first step, the concept of CUX patterns [9] is introduced to the targeted HCI researchers (novices as well as experts). We split this first step into the following four sub-topics.

Outline of Major Goal (1): The major goal of our guidance tool was to support a structured pattern generation process in order to preserve and pass on knowledge from empirical study findings in the form of a pattern. This goal was first outlined in the guidance. Literally, it was defined as “Collecting and sharing UX and context related knowledge (based on empirical results either gathered within your own study or from literature) in a structured way by using a pattern form!” After outlining our major goal, we have included a visualization of an exemplary pattern in the guidance based on [8] with an UX focus on involvement and motivation (see in detail [26]). This should help the researchers to get a better impression about what CUX patterns are and how they are structured.

Characteristics of Patterns (2): After explaining our major goal and presenting an exemplary CUX pattern, the guidance provides an overview on the most important characteristics of patterns. Based on Vlissides [17], we defined the following eight aspects to be essential when creating a pattern especially for HCI researchers that are not experienced in developing patterns:

**What you need to know about patterns!**

- ① They capture expertise and knowledge to make it accessible to experts as well as non-experts.
- ② Their names collectively form a vocabulary that helps developers to communicate better.
- ③ They help people understand a system more quickly when it is documented with the patterns it uses.
- ④ Patterns represent a structured way to represent and communicate knowledge.
- ⑤ Using the same vocabulary avoids misunderstandings and ambiguities.
- ⑥ Patterns are abstract enough to make generalizations but as well detailed enough to provide practical solutions or suggestions.
- ⑦ Patterns are easy to understand (in a unified and human-readable format).
- ⑧ Patterns are short enough so that the knowledge can be accessed quickly.

Patterns within the Specific Project (3): Next, our guidance describes the purpose of CUX patterns and intended stakeholders within the targeted project. Furthermore, the definition of CUX patterns is provided to the researchers (see Section II.B).

Additional Information on Patterns (4): To provide further and more detailed information about patterns, we added some links that deal with software patterns, pattern languages (see [23]) as well as general information on

patterns such as selected collections and publications (see [24]).

*B. Step II: Reflect and Select Your Key Finding(s)*

After giving the researchers a brief overview and input regarding patterns, the next step of the guidance focuses on the reflection and selection of relevant UX related results from empirical studies conducted by the researchers. This is one of the key steps within our process, since the process of reflection is the most important activity in pattern creation according to Vlissides [17]. We provide three text boxes within the survey, asking the researchers to select and summarize three findings. We have decided to provide three text boxes for the key findings in order to ensure that at least one of the key findings is appropriate for a pattern. These findings should be gathered within their studies and should represent insights on UX. Each key finding should be entered in one box.

In order to support the researchers in recognizing appropriate results to create a pattern with, we remind them within that part of the guidance that the main goal of generating the patterns is, to collect and share UX related results that have been gathered within their study in a structured way. After the researchers have entered three UX related key findings, we ask them in a next step to reflect on their chosen findings. Therefore, we ask the researchers to analyze their key findings according to the following aspects. These aspects ensure that they will be able to create a pattern and meet the predefined structure of our suggested CUX pattern based on their key findings:

**Analyze according to the following checklist!**

- ① My key finding addresses a/some specific UX factor(s).
- ② I can give a detailed and further description of my result(s).
- ③ I can describe the context from which my chosen key finding is extracted/gathered from
- ④ I can create design suggestions from these results.
- ⑤ I can underpin or visualize my design suggestions with examples.

After this checklist, the previously entered key findings are visualized again to ensure that the researchers can directly check their entered results and reflect on them according to the pointed out aspects outlined above. If the researchers were not able to identify any UX related key findings that satisfy those needs, we ask them to have a closer look at their results again in order to identify a potential UX related result there. By including this reflection cycle in the guidance, we want to ensure that the researchers proceed with an appropriate result to be able to create a pattern.

C. Step III: Develop Your Pattern

TABLE I. STRUCTURAL OVERVIEW OF OUR PATTERN

Instructions on Each Pattern Section		
#	Section Name	Instruction on Each Section
1	Name	The name of the pattern should shortly describe the suggestions for design by the pattern (2-3 words would be best).
2	UX Factor	List the UX factor(s) addressed within your chosen key finding (potential UX factors listed in this section can be e.g. workload, trust, fun/enjoyment, stress...). Please underpin your chosen UX factor(s) with a definition.
3	Key Finding	As short as possible - the best would be to describe your key finding (either from an empirical study or findings that are reported in literature) in one sentence.
4	Forces	Should be a detailed description and further explanation of the result.
5	Context	Describe the detailed context in which your chosen key finding is extracted/gathered from.
6	Suggestions for Design	<ol style="list-style-type: none"> <li>1) Can range from rather general suggestions to very concrete suggestions for a specific application area.</li> <li>2) The design suggestions should be based on existing knowledge (e.g., state of the art solutions, empirical studies, guidelines, ...).</li> <li>3) More than one suggestion are no problem but even better than only one.</li> <li>4) There can also be a very general suggestions and more specific "sub-suggestions".</li> </ol>
7	Example	Concrete examples underpinned by pictures, standard values etc. Examples should not provide suggestions (this is done in the suggestion part) but rather underpin and visualize the suggestion presented above.
8	Keywords	Describe main topics addressed by the pattern in order to enable structured search.
9	Sources	Origin of the pattern (e.g. literature, other pattern, studies or results)

After the reflection cycle in Step 2, the researchers should be ready to actually create their own CUX pattern. Therefore, the pattern guidance again reminds them that their generated patterns should 1) capture expertise and knowledge, 2) be abstract enough to make generalizations, 3) but as well detailed enough to provide practical suggestions and 4) be easy to understand in a short and concrete manner. In order to support the researchers to meet these goals, we show them a predefined pattern structure visualized as a table. This provides an overview on the sections to be filled in. Further, this should encourage the researchers to keep our suggested structure. Our patterns are structured according to the nine sections (see section name) shown in TABLE I. The researchers are then asked to fill in the sections sequentially according to the given instructions below each section. In TABLE I. the instructions according to each section are outlined in more detail. After proceeding through each of these sections, the researchers have developed a first version of their CUX pattern based on their empirical results.

D. Step IV: Final Check

In order to ensure that the researchers have successfully conducted the process of pattern writing and met our predefined format of CUX patterns, we ask the researchers in a fourth step to have a final look at their pattern according to the following points:

**Have a final check!**

- ① Do a spell check by reading the pattern from the beginning to the end.
- ② Check if all sections are filled in appropriately.
- ③ Check if you have written everything in an easy and understandable way.
- ④ If you want to insert e.g. pictures, links in the "examples" or "sources" section, check if you have attached them.
- ⑤ Check if you are as concrete and short as possible.

To support the researchers in checking their generated pattern, we visualize the generated pattern below this checklist to make it easier for the researchers to assess if the generated pattern fulfills all the criteria listed above.

E. Step V: Feedback

In a last step, the guidance asks the domain specific researchers to provide feedback on the pattern generation process. Thus, we get insights on how to improve the guidance as a basis for further iteration. Therefore, we developed a short questionnaire (9 items) focusing on helpfulness, effort, difficulties, and concrete problems when using the pattern generation guidance.

IV. EMPLOYMENT OF THE PATTERN GENERATION GUIDANCE

In order to evaluate the guidance in terms of helpfulness, effort, task difficulty, and other issues occurring when applying our guidance, we have conducted a first pre-test with one HCI researcher who has had no previous experience in generating patterns. This initial evaluation cycle allowed us to get insights on the applicability and weaknesses of the guidance in practice. Based on these insights, we iterated our guidance especially for researchers with no previous experience in generating patterns. The pre-test was conducted in December 2012 and the researcher needed two hours to create his/her pattern out of gathered empirical results; we had expected that the generation process would generally take much longer.

TABLE II. represents the major issues evaluated during the pre-test, which have been clustered in four different problem categories. Apart from these more significant issues, the HCI researcher has also reported about minor issues, such as spelling mistakes and design issues of the survey. These minor issues are excluded from the reported problem categories below, since these issues are not relevant to the

aim of the guidance and are easy to correct and do not need to be outlined in much more detail.

TABLE II. REPRESENTATION OF IDENTIFIED PROBLEMS

Overview of Identified Problems		
Problem Category	Identified Problems	Reference to Guidance
Sequence	(1) Sequence of sub-steps could be structured more clearly and intuitive	(1) Step 2
	(2) The chosen key-finding from Step 2 should appear in Step 3 again	(2) Step 3
	(3) Sequence of the sections (in the pattern structure) is not intuitive enough, since this is not the way how people create a pattern in their mind	(3) Step 3
Wording	(4) For Step 2 and 3 the wording "pattern" within the guidance is misleading since this would imply that the HCI Researcher already has to have the outcome in his/her mind	(4) Step 2 and 3
Repetitions/ unneeded information	(5) Detailed definition of Patterns is unnecessary, since the guidance should guide you how to create a pattern, therefore it's not necessary to know a definition of what patterns are in our case	(5) Step 1/C
	(6) Graphical visualization of general pattern structure is shown again, which is unneeded information at that point	(6) Step 3
Text complexity	(7) The provided information in Step 3 (especially the reminder) is formulated too long and complex	(7) Step 3
	(8) The provided input in the introduction section is too long and not to the point	(8) Step 1

Overall, three problems were evaluated that relate to the sequence of different steps and sub-steps within the guidance. The pre-study participant reported that the sequence for the different sub-steps within Step 2 and 3, need to be iterated, in terms of making the sequences more intuitive and clear for the researchers. This means that for example, the reported problem number (3) 'the sequence of sections in the pattern structure' should be switched since the current sequence is not supporting the researchers, how they intuitively would generate a pattern in their mind. Therefore, we would suggest to change the sequence, in an iterated version of the guidance, as followed: 1) Pre-step, where the chosen key finding (from step 2) by the researchers is visualized again, 2) Forces, 3) Context, 4) Suggestions for Design, 5) Example, 6) Key Finding, 7) UX Factor, 8) Keywords, 9) Sources, 10) Examples. In order to check, if the sequence change of the sections makes it easier and more intuitive for the researchers to generate their pattern, we aim to test this changed order of sequences in another pre-test.

Besides this suggestion how to improve the guidance in terms of sequence changes in the pattern structure when generating the pattern, other areas for improvement could

have been identified. Within Step 1 (introduction on patterns) especially, some parts of the guidance contain of unneeded/unnecessary information that is formulated rather complex at some parts. Our pre-study participant reported that some sections/parts (e.g. detailed definition of what CUX patterns are) do not have to be part of the guidance, since the guidance itself should direct the researchers in a way, that the generated pattern complies with our view on what CUX patterns for a structural representation of empirical study results are. Therefore, we aim to reduce such unneeded information in terms of deleting these sections and, therefore, reduce the information flow and complexity of the guidance. As another step to reduce the information overflow, we aim to formulate the different instructions/information shorter and especially formulating these parts more active in terms of "Researcher, do this... do that..." in order to provide short and concrete instructions for the researchers. This might reduce the potential of misunderstanding some parts.

Summarizing our first use of the guidance, we can state that when generating a pattern out of empirical study results, it is important to address an intuitive sequence of the different sections and steps, as well as to be concrete, short and to the point with the instructions provided in the guidance for the researchers.

## V. CONCLUSION AND FUTURE WORK

In this paper, we introduced a step-by-step pattern generation guidance to support non-pattern experts in the generation of patterns and to support a traceable pattern generation process. Thus, knowledge gained within empirical studies is captured in the form of CUX patterns. We claim that our pattern generation process supports explicit knowledge regarding pattern development, and thus makes it easier to share and access knowledge with other HCI researchers. By applying our approach, we preserve and structure UX and context related knowledge gained within research projects and thus make knowledge accessible for researchers. Further, the researchers have to reflect on the quality of their empirical results which effects also the quality of the generated pattern. However, the presented approach also has some shortcomings. For example, the initially suggested sequence of the pattern generation was not intuitive, as turned out in the employment of the guidance. This issue will be addressed in an iterated version of the guidance. Another weakness of the presented approach is that patterns sometimes might not be the right format to represent empirical results. However, we believe that in most cases, patterns are able to summarize insights on contextual user experience.

We are aware that there is still space for improvement of our approach. For example, we would suggest that researchers could take different sources for their pattern. For instance, a researcher could take one key finding from his/her study, and the rest from reported literature. Using various resources (e.g., a published paper from the field, other domain-specific patterns, norms or guidelines) helps researchers to reflect about their relevant key finding, to combine it with relevant aspects and thereby, increases the

quality of the generated pattern. According to Appleton [18], patterns should tell us a story, which captures the experiences they are trying to convey. In this context, we found that the right sequence of our pattern guidance is important. Especially Step 5, which asked to describe the context, should be represented earlier within the generation process. Further, we will support the researcher by listing six contextual categories to be selected: user context, system context, social context, temporal context, physical context, and the category “others”. By presenting concrete contextual categories, we assist the researchers to assign the key finding to the specific context. With such detailed information about the context, we get a deeper understanding of the relevant context.

In general, we consider the development of the pattern generation guidance as an iterative process, which demands continuous evaluation. In a first step, we plan to iterate the pattern sequence according to the drawbacks reported in the first employment of the guidance. In particular, we will change the different sections and check if this order is more intuitive for the researchers. Another issue for future work is the extension of the guidance towards a validation of the created patterns [22]. This will be easy to realize as the patterns are already digitalized and can be provided to others for validation. Further, we will conduct an expert workshop on the suggested process in order to identify further improvement potentials. After iterating the guidance, we will employ the pattern generation guidance in the field by providing the guidance to HCI researchers, with differing experience in generating patterns, in order to collect patterns for the automotive, home, and mobile context.

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