Selection Support of Digital Service Design Techniques for Design Novices

Xuanhui Liu
Supervisor: Alexander Maedche

Karlsruhe Institute of Technology (KIT),
Institute of Information Systems and Marketing (IISM), Karlsruhe, Germany
xuanhui.liu@kit.edu

Abstract. In order to create extraordinary user experiences, digital service design processes involving people from a multi-disciplinary background need to be executed. With the growing number of executed design processes, it becomes increasingly important to quickly onboard design novices in these processes. A huge amount of design techniques is available to be used in various design situations. However, too-much-choice can cause confusions in the selecting process. Selecting appropriate techniques remains a challenge, especially for design novices. This doctoral project focuses on providing support for design novices to select design techniques to improve their working performance in the design process. Several artifacts in the form of different types of classifications and software-based platforms are developed, which guide novices to select design techniques in digital service design processes.

Keywords: Digital services, Design techniques, Classifications, Selection support

1 Motivation

Nowadays, organizations become increasingly aware of the new challenges in the digital world, such as changes in user behavior, and increasing competition [1]. IBM predicted that by 2020, 85% of interactions between customers and companies would be handled by human-free, digital-only services [2]. In order to provide services with high usability and user experience, more and more organizations recognize the importance of design-oriented approaches [3]. In design-oriented companies, the ratio of designers to developers is between 1:5 and 1:4, but the average ratio of designers to developers in companies is still 1:17 [4]. Designers in design-oriented companies write best practices for improving user experience, e.g., using a storyboard to analyze usage scenarios [5], using touchpoint matrix to understand user interactions with the system [6]. By applying appropriate design techniques in design processes, people can not only have guidance for their design activities, but also enforce their team coherence. However, there are hundreds of design techniques [7, 8], and different companies have different design resources and situations [4]. Not all techniques are appropriate for all design situations. Before using a design technique, people need to decide

which one to select, but the expansion of the set of design techniques causes many alternatives which increases the difficulty of making decisions [9, 10]. Hence, it is necessary to reduce the complexity to support the selection, especially for design novices. In this proposal, people with little or no formal training in selecting and applying design methods and techniques are called "design novices." Design novices may have chances to work with design experts to know how to use certain design techniques for the certain situations. But new situations may appear, and experts are not always available, especially in the development organizations with limited design resources [11, 12]. To simplify the selection process, a selection support of design techniques, which focuses on design novices need to be provided.

In the literature, classifications of design techniques are developed for providing an overview of design techniques as a basis for supporting the selection. Most of the existing classifications of design techniques are built based on experts' knowledge [13, 14], which may not reflect novices' understandings of design techniques. Based on the existing classifications, there are also websites (e.g., thedesignexchange.org) that provide filters and search functions for selecting design techniques. Existing Web-based tools lack the consideration of novices' understanding of design techniques. However, experts and novices have different categorization behaviors [15, 16]. Experts tend to build classifications with hierarchical categories from a top-down manner, while novices incline to classify entities into flat categories (i.e., unstructured tags) by following a bottom-up approach [15, 16]. Novice-based classifications have a wide application, for example, user-knowledge based tag clouds are usually used for searching information in website navigation [17]. Hence, novices' understandings of design techniques should be considered to better support the selection. Furthermore, the effect of classifications on the selection of design techniques has not yet been evaluated in the literature. Although classifications are studies that can help with the selection for certain purposes [18], how much can classifications help novices to select design techniques is still blank at present. Besides filtering design techniques by using classifications, there are studies analyzing co-occurrence of design techniques for specific projects based on case studies [19, 20]. However, a system that can suggest design techniques for specific design situations with the consideration of novices' understandings has not yet been developed.

With my doctoral research project, I seek to close this practically and scientifically relevant research gap by suggesting and systematically evaluating different forms of selection supports in order to support design novices to select design techniques.

2 Research Question

Based on the theoretical and practical motivations, this doctoral project seeks to answer the following research question: *How to support design novices in digital service producing organizations with limited resources of design experts to select digital service design techniques?*

Before developing a software-based artifact for supporting the selection process, a clear overview of design techniques needs to be provided. We, at first, classify design

techniques to reduce the complexity and present the similarities and differences of design techniques, which is a basis for further analysis of the selection of design techniques [21]. Classifications are widely used in information architecture, which benefits people in many aspects, for example, helping job seekers to find appropriate occupations [22]. Because we seek to help novices to select design techniques, we need to understand novices' understandings of classifying design techniques. Hence, the first break-down research question is: *What categories build classifications of design techniques from both experts' top-down and novices' bottom-up perspectives?*

Based on these classifications, a software artifact is developed to provide simplified access to the classifications. Additionally, by using the classifications, the effect of different types of classifications in the selection process will be analyzed, which will further optimize the selection support for novices. Thus, the second break-down research question refers to: *How to instantiate the classifications and how can classifications influence the selection process?*

The categories in the classification can reduce the complexity and help with the searching, but the categories cannot be directly used to suggest design techniques. The categories of design techniques need to be connected with design situations. For example, design techniques can be suggested by considering design stages and available resources (e.g., time, equipment, etc.) in the design process. Thus, the third break-down research question is: *How to suggest design techniques under consideration of contextual factors of a specific design situation?*

3 Research Method

In order to answer the research questions, this research project follows the design science research methodology [23]. Figure 1 presents three design cycles, and each cycle is to answer a break-down research question. There are five steps under each cycle. After identifying problems, we suggest potential solutions and conduct developments, we then evaluate the results and conclude each cycle.

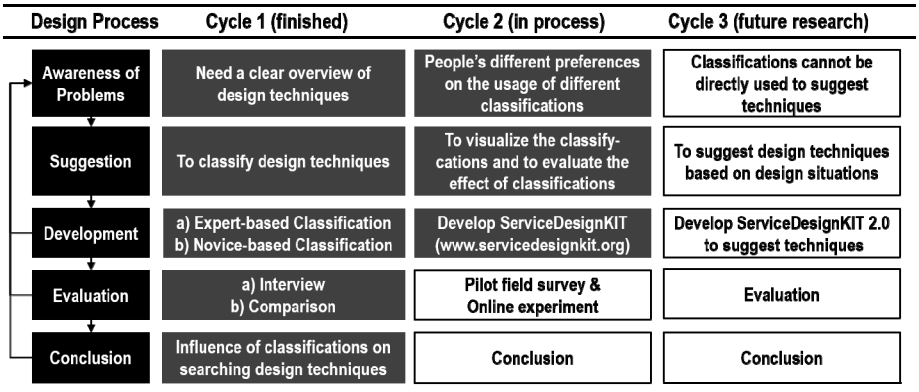

Fig. 1. Overall design science research approach. The steps in dark gray color mean we have completed; white color means we have ideas for these steps.

Before starting to develop a software artifact for supporting the selection process of design techniques, we analyze the similarities and differences between design techniques in the first cycle. As this research seeks to help novices to select design techniques, we develop two classifications. One is based on experts' knowledge (an expert-based classification), another reflects novices' understandings of the content of design techniques (a novice-based classification).

In the second cycle, based on the development of the expert-based classification and novice-based classification, a Web-based tool (ServiceDesignKIT) is developed to instantiate the classifications. Besides providing a selection support, ServiceDesignKIT (servicedesignkit.org) enables its users to edit design techniques and the categories. By using the Web-based tool in the field, we can see whether classifications can help with the selection process. But the effectiveness of different types of classifications in the selection process cannot be reflected by the tool. In addition, people may have different preferences for using different classifications. Thus, an experiment needs to be conducted. In the experiment, we seek to understand the effect of classifications on the selection process and whether novices' cognitive styles can influence the use of different classifications.

Besides providing classifications for selecting design techniques, more specific support of suggesting design techniques is needed. The third design cycle will focus on suggesting design techniques under consideration of contextual factors of a specific design situation. Different design situations and the applied design techniques are summarized by literature review and expert interviews.

4 Preliminary Results

So far, an expert-based classification and a novice-based classification are created. A Web-based tool is developed to instantiate the classifications. The collected feedback of the pilot field deployment of ServiceDesignKIT provides suggestions for further evaluation and development.

4.1 Cycle 1: An Expert-based Classification and a Novice-based Classification

By using Nickerson's taxonomy development method [24] and expert interviews [25], a top-down expert knowledge-based classification of digital service design techniques is developed (Fig. 2) [26]. The classification includes five dimensions: design phase, time dependency, duration, user participation, and evaluation type. Each dimension includes mutually exclusive and collectively exhaustive categories. For example, planning, draft prototype, detailed prototype, and launching belong to the dimension design phase. The expert-based classification tells differences and similarities between design techniques from the experts' perspective. Besides the expert-based classification, we also need to understand how novices classify design techniques. Thus, we conducted open card sorting with novices to build a novice-based classification [27]. 40 students who study computer science, information economy, and human-computer interaction were involved in the open card sorting exercise. The 40 students

have attended design-related courses (e.g., digital service design, design management, etc.). They have basic design knowledge, but do not have practical experiences. Thus, we consider students as novices in the card sorting exercise. We randomly assigned two students in a team and built 20 teams to avoid bias from a single person in the sorting process. Students were asked to sort cards based on their understandings of the descriptions of design techniques. 20 teams created 110 categories. As some of the created categories have the same meaning, we used exploratory analysis to merge the similar categories and created 16 standardized categories (Fig. 2). The standardized categories reflect that novices categorize design techniques from five dimensions: design phases, activity types, participants, purpose, and duration. However, novices did not connect dimensions with the categories in the created classifications. The novice-based classification contains flat categories without a hierarchical structure. The differences between the expert-based classification and the novice-based classification reflect that there are differences between experts' and novices' understandings of design techniques, which may influence the use of classifications. It is interesting to investigate whether classifications can help with the selection of design techniques and what kind of classifications can help novices to perform better in the selection process. In the second cycle, we intend to answer such questions.

Expert-based Classification	**Design Phase** Planning Draft Prototype Detailed Prototype Launching	**Evaluation Type** Group Discussion Observation Experiment Questionnaire Interview	**Duration** Short Term Long Term	**User Participation** Without Real User User Involved	**Time Dependency** Retrospective Real Time
Novice-based Classification	User research, Idea generation, Information organization, Feedback collection, Prototype evaluation, Prototyping, Evaluation, Expert participation, Product evaluation, Collaboration with stakeholders, User participation, Short-term duration, Long-term duration, UX evaluation , Mid-term duration, Relationship and dependency				

Fig. 2. Expert- and novice-based classifications

4.2 Cycle 2: ServiceDesignKIT

Cycle 2 includes instantiating the classification as a filter and evaluating the effects of classifications on the selection process. Currently, we finished the development of an initial version - ServiceDesignKIT (servicedesignkit.org), but the experiment is still in process. So far, in ServiceDesignKIT, we implemented the expert- and novice-based classifications as a filter. Users can use the expert-based classification (1 in Fig. 3) or the novice-based classificaiton (2 in Fig. 3) or both to filter and find design techniques. The selected design techniques can be saved to a shortlist for retrieving by clicking the heart symbol (4 in Fig. 3). So far, 71 design techniques are currently included in the Web-based tool. It is impossible to contain all design techniques. Thus, the tool offers an open knowledge base to enhance or change the content (3 in Fig. 3) and a control system to intertwine the open knowledge base. Users are expected to add and edit design techniques in ServiceDesignKIT. Users are also enabled to leave comments and communicate to exchange knowledge (5 in Fig. 3).

We attempted to use ServiceDesignKIT as a supplement to a Master lecture. In the lecture, students participated a capstone project, in which students used design techniques and created low-fidelity prototypes for a financial service App which was provided as a real challenge by one of our industry partners. Students can use ServiceDesignKIT to select appropriate design techniques for their capstone projects, but we did not force them to use it. We used a questionnaire to collect students' feedback on ServiceDesignKIT. In the questionnaire, we evaluated perceived ease of use, perceived usefulness, intention to use, output quality, and user-system relationship [28, 29]. The evaluation result demonstrates that ease of use, perceived usefulness and output quality are high, but the intention to use and user-system relationship are relatively low. Some of the students' feedback reflects that they expect the tool to provide examples of applications of techniques in practice. After analyzing the effect of classifications on selection support, further development of the tool will be conducted.

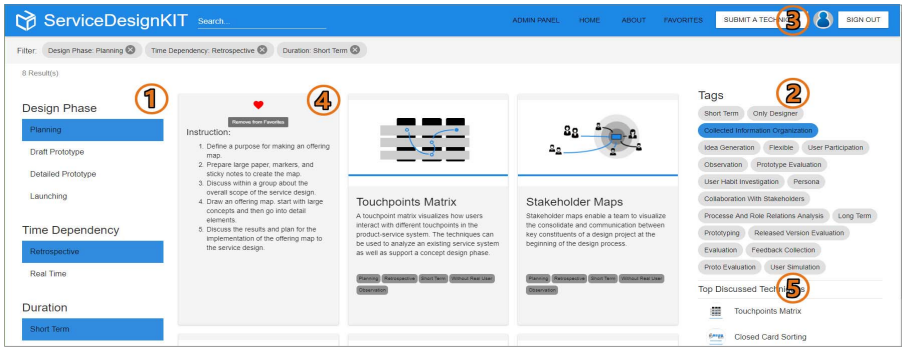

Fig. 3. A screenshot of the homepage of ServiceDesignKIT

5 Planned Research

In the future, we plan to execute an online experiment to systematically analyze the effect of different classifications on the selection of design techniques (cycle 2). Furthermore, we plan to develop a tool to suggest design techniques by considering contextual factors of specific design situations (cycle 3).

5.1 Online Experiment

The planned online experiment seeks to explore how different classifications influence task performance and whether cognitive styles can influence the selection of design techniques of novices. The experiment participants will be asked to select appropriate design techniques for a specific task. The task is defined based on the existing literature which introduces the use of design techniques and is validated with feedback from experts. The quality of the selection results by using different classifications will be compared. Additionally, I will collect participants' feedback on the perceived selection confidence, task performance, and selection accuracy. Several

questions will be followed after finishing the experiment task. Currently, we developed an online experiment tool and started a pre-test. I plan to conduct the experiment with large-scale sample size after more pre-tests. The experimental results may influence the development of ServiceDesignKIT 2.0. Especially, we may provide specific classifications for novices based on their cognitive styles.

5.2 ServiceDesignKIT 2.0

The pilot field evaluation of ServiceDesignKIT demonstrates the need for adding tangible examples of applying design techniques in the Web-based tool. Furthermore, there is a need to further contextualize the selection process based on specific design situations. ServiceDesignKIT will be upgraded with new features which enable the suggestion of design techniques based on contextual factors of specific design situations. Initial information on design situations and appropriate design techniques will be extracted from the literature review and expert interviews. Furthermore, data of design situations and used design techniques will be collected continuously by enabling users to document design projects that they have participated and suggest design techniques they have used in the specific situations in the Web-based tool. In order to make sure the collected design techniques can actually contribute to project success, users will be asked to answer several questions to evaluate the project performance [30, 31]. The design techniques from successful projects will be suggested when using ServiceDesignKIT 2.0 in the future. Besides that, a survey that is independent of the tool will be conducted with experienced design practitioners in order to collect design techniques that have been used for specific design situations. With this data, we plan to build up a situation-dependent design techniques knowledge base.

6 Conclusion and Expected Contribution

This doctoral project proposal describes the current status and plans of our research in the field of providing selection supports for digital service design techniques for design novices. I follow the design science research methodology and run three design cycles. The developed artifacts are expected to be provided to help novices to select appropriate design techniques. The doctoral project expects to deliver several theoretical contributions. Following Gregor (2006) [32], we contribute to a type I, II, and V theory. In cycle 1, we provide an expert- and a novice-based classification of design techniques and analyze similarities and differences of categorizing design techniques between experts' and novices' perspectives, which can be seen as a theory for analysis (type I theory). The analysis advances the theoretical understanding of the differences and similarities between experts and novices in categorization behaviors in the context of classifying design techniques [16, 33]. The comparison between experts and novices is a starting point for further analysis on which kind of classifications is more appropriate for novices to select techniques. In cycle 2, in order to evaluate which classifications can better help novices with the selection of design techniques, we instantiate the expert- and novice-based classifications and will further explain the

effect of classifications on the selection of design techniques by experiment, which can be seen as type II theory for explanation. The instantiation is an attempt at using the classifications in practice. The experiment seeks to explain whether novices' cognitive styles can influence the use of different classifications, which can further contribute to the theoretical understanding of cognitive differences in the research of information systems [34]. Based on the analysis and explanation, this study seeks to provide a software-based artifact which can be used to suggest techniques based on different design situations for novices (type V theory), which will be conducted in cycle 3. From the practical perspective, the artifact represents a selection support system to help design novices to select techniques for different situations, which can further help to improve novices' performance in deciding appropriate techniques.

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