Suggestions of Prototyping Tool for Service Design Co-Creation

Focusing on Mobile Application

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Abstract: In service design prototyping process, efficient co-creation tool is necessary for stakeholders to easily access to service prototyping. However a system satisfying such needs has not been realized yet. Conventional online prototyping tools have limitations to be applied to service design since they are mostly developed for UX design. Therefore, this study aims to present a prototyping tool which can be used for co-creation without limitation of time and place. For this study, we have investigated features of 10 online prototyping tools for service design and selected six tools to analyze their functions and features. We have also interviewed five service designers to identify requirements concerning service design prototyping. Then based on insights gained from the above research, we have proposed a service design prototyping tool with co-creation function which is applicable to mobile application in service design. The proposed service design prototyping tool has functions of ‘chatting’, ‘white boarding’ and ‘file sharing’ to provide faster communication and real-time user feedback. ‘Library’ in the tool provides three iconized components such as stakeholders, service items and service scape which are essential for service prototyping.

Key words: Service Design, Prototyping Tool, Co-Creation, Mobile application

1. Introduction

It is important to select proper service design prototyping tools to express service design concepts as it affects quality of service design prototyping and furthermore service design itself. Among service design prototyping tools, frequently used tools are those by which stakeholders participate in role play and experience a service, and those which simulate the process and situation of a service using simulation tools and mock-up. Though these tools are useful for service design prototyping, they still have limitations to be used in co-creation due to their restrictions on time and place. Accordingly, this study is to propose a prototyping tool which is usable for a mobile device, which allows various stakeholders to generate and share ideas and get quick feedback from each other whenever and wherever they want.

We have limited the scope of this study to the development of online prototyping tool used in the early stage of a service design process in order to quickly test service design concepts. This prototyping tool is low in fidelity compared to one used at the latter stage of service design process for making high quality service design prototype. For this study, we have investigated features of 10 online prototyping tools which can be utilized for service design. After reviewing of functions by each tool, 10 key words are extracted and used for analyzing functions and

features. Secondly, among those prototyping tools, we have experienced six tools and analyzed their functions and features. Thirdly, we have identified user requirements in interviews with five designers working in service design companies. Lastly, based on the case studies and user interviews, we have come up with design concepts and then proposed a mobile application for service design prototyping.

2. Service Design Prototyping and Co-creation

2.1 Definition of Service Design Prototyping

Service design prototyping is a means by which service stakeholders reenact service concepts in diverse ways which are created during service design process and test feasibility of the service concepts. During service design prototyping, each participant of it takes a role of stakeholders such as customers and service providers described in service scenario. To facilitate the role play, physical prototypes of objects and backgrounds depicting service situations which are made from paper, cardboard, or Lego bricks etc. are used. Instead of physical prototypes, computer modeling of objects and backgrounds can also be used. Service design prototyping is necessary because customers cannot evaluate a service without experiencing it in person. While reenacting the scene of a service with various tools, we are able to identify problems and set directions to improve them.

2.2 Prototyping in Service Design Process

Methods of service design prototyping depend on which stage of a service design process a service design prototype is made. A prototype made in the early stage of a service design process is quickly created with simple materials and used service stakeholders to test, modify and develop service ideas. The prototype made in the early stage has characteristics of low fidelity and high speed, and information gathered from prototyping can be reflected in the following design process. On the other hand, the prototype produced in the latter stage of service design process is characterized by high fidelity and low speed. This high fidelity prototype is appropriate for evaluating a service concept in detail and mostly used to present final design of a service.

2.3 Co-creation in Service Design

Co-creation is a core aspect of the service design philosophy. It involves anyone from staff, designers, executives or customers working collaboratively in order to examine and innovate a given service experience. [5] Co-creation in service design is useful for reflecting stakeholders' opinions. It is a good opportunity by which users as well as designers and service providers are able to come up with solutions to problems concerning a service while they are sitting together and talk about the service. Co-creation is usually progressed in the form of a workshop. If users concerned with a certain service have an opportunity to participate in a co-creation workshop for a project, they will feel strong affinity for the project and become supporters of it.

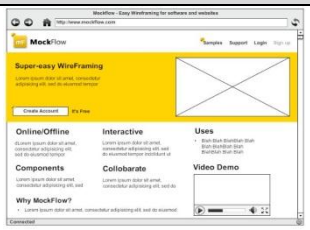
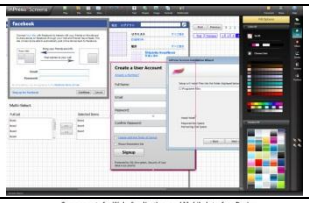
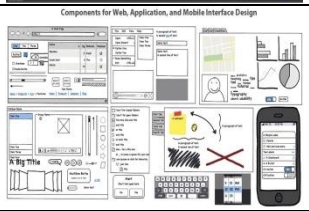
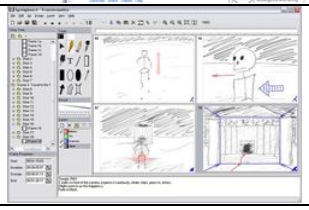
3. Cases of Service Design Prototyping Related Tools

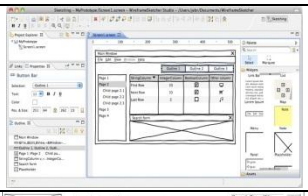
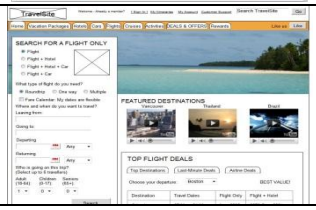
3.1 Case Study

In order to get insights for design concepts, we have conducted a case study on existing prototyping tools. To do this, through the internet, we have collected 10 online prototyping tools which are related to service design and identified their characteristics based on the contents introduced on their homepages. These 10 prototyping tools

are mainly for producing UX prototypes of web site, web application, mobile application and desktop application. Since all these prototyping tools put detailed instructions at their homepages, users are able to identify their features and functions before they use them.

Table 1 Service design related prototyping tools

Tool	Image	Description	Feature	Use type
MockFlow		Made with super-easy wire framing concept, it can be used anywhere without internet connection.	- On-line/Off-line - High-Fidelity - Icon - Share/Chat/Real-time - Back-up - Drag and Drop - Link	Web site Desktop app Web Application Mobile app
HotGloo		Providing interface elements to design wire frame and mock-up, it makes a user communicate with team through chatting function.	- On-line/Off-line - Low-Fidelity /High-Fidelity - Chat/Real-time - Back-up - Drag and Drop - Link	Web site
inPreso Screens		A blue print tool used to design and define motions of interfaces of applications and web site.	- On-line/Off-line - Low-Fidelity /High-Fidelity - Share/Real-time - Drag and Drop - Link	Web site Desktop app Web Application Mobile app
Balsamiq Mockups		Offering the same rough feel as sketching with a pencil, it enables designers, product managers, and even clients to work together.	- On-line/Off-line - Low-Fidelity - Icon - Share - Drag and Drop - Link	Web site Desktop app Web Application Mobile app
Protoshare		Co-creation tool used for making web site wire frame and application prototype in real time.	- On-line - High-Fidelity - Icon - Share/Real-time - Drag and Drop - Link	Web site Web Application Mobile app
Mocking-bird		On line tool which is easy to make, connect each other, preview and share mock ups of web site or applications.	- On-line - Low-Fidelity - Icon - Share/Real-time - Drag and Drop - Link	Web site Web Application Mobile app
Spring board		It allows a user to draw sketches and put footnotes to dynamic mediums such as animation and moving images.	- Off-line - Low-Fidelity - Icon - Drag and Drop - demo & test	Desktop app

justproto		It allows a user to share contents preview and single URL with clients and team members.	- On-line - Low-Fidelity /High-Fidelity - Icon - Share/Chat/Real-time - Drag and Drop - Link	Web site Web Application Mobile app
Wireframe Sketcher		A tool appropriate to quickly make mock ups with hand drawing style.	- On-line - Low-Fidelity - Icon/Template - Share - Drag and Drop - Link	Web site Desk top app Mobile app
Pidoco		A web based software with quick production and ease of usability; it is used to make wire frame.	- On-line - Low-Fidelity - Icon/Template - Share/Real-time - Drag and Drop - Link	Web site Web Application Mobile app

3.2 Function Analysis through Case Studies

Through case studies on functions that each prototyping tool provides, we have drawn 10 key words which are related to service design prototyping tools. (Table 2) Such keywords have been used as criteria to analyze characteristics and functions of service design prototyping.

Table 2 Keywords used as criteria for function analysis

Function		Description
1. Co-Creation	Share	Allow users to share ideas in SNS, email and café etc.
	Chat	Allow a user to have real time conversation with co-creators during prototyping.
	Real-time	Function for real time co-creation
2. Library	Component	Visual elements provided as basic components.
	Template	Sample or formats provided as basic components.
3. Link		Function for connecting a page to other pages.
4. Compatibility	Import	With this function, various types of files can be imported during prototyping.
	Export	With this function, results of a work can be converted to various types of file.
5. Annotation	Text input	Function used for adding comments to a prototype.
6. Back up	Auto save	Function by which work data is automatically saved.
7. Drag and Drop		Allow users to grab an object and then drag it to a different location.
8. Grid		Baseline function used to arrange or locate objects.
9. demo & test	Presentation	Allow users to preview or test a view.
10. Storyboard	View mode	Graphic organizers in the form of illustration or images displayed in sequence.

The service design related prototyping tools commonly provide ‘co-creation’ functions such as ‘share’, ‘chat’ and ‘real time’ and ‘library’ functions allow users to easily make prototypes by providing built-in components and templates. Also with ‘link’ function users are able to connect a page to other pages. ‘Compatibility’ functions allow users to change results of work into different format. With ‘drag and drop’ function, users are able to easily bring components to canvas when they want, and arrange and locate them with ‘grid’ function. They, however, have limits for creative works because they only provide ‘component’ and ‘template’ to users without having functions with which users in person make sketches and prototypes.

3.3 Characteristics Analysis

We have analyzed features of prototyping tools according to the criteria of ‘relevance to service design’, ‘reproducibility’, ‘acceptability’, ‘usability’, ‘production time’, ‘diversity’, ‘tool utilization’, and ‘stage’ where a prototyping tool is used. These criteria for the characteristics analysis have been created while modifying the criteria developed by Eun-Byeol Keum et al. (2012) to analyze service design prototyping tools. [2] In their paper they proposed ‘level of difficulty’, ‘production cost’, ‘production time’ and ‘tool utilization’ as the criteria for tool analysis.

To do this, we have given a form for analysis to four people who have experience in service design projects and have them use six prototyping tools and check the tools on a four-point scale. After calculating average value from the result, we have made a table which shows the characteristics of service design related prototyping tools. Table 3 shows a result of such analysis. From the result, we have realized that a prototyping tool with low fidelity is high in adaptability and takes less time to produce for its ease of use due to simple functions and a small number of libraries. On the other hand, a prototyping tool with high fidelity provides a lot of functions so it is comparably low in user’s adaptability and takes more time to produce as it requires learning of instructions at homepages to understand its functions. This shows that utilization of prototyping tools with low fidelity is high. It appears that a prototyping tool produced in the early stage of service design is created for quick communication among team members by quickly making it with low fidelity. We have realized that the co-creation prototyping tool that we are trying to propose should have features of low fidelity, high speed, high adaptability and usability.

Table 3 Analysis for service design related prototyping characteristics

classification		Relevance to service design	Reproducibility	Acceptability	Usability	Production time	Diversity	Tool utilization	Stage
Low fidelity	Balsamiq Mockups	●	•	⬤	⬤	•	•	⬤	Early stage
	Wireframe Sketcher	●	●	●	●	•	●	●	
	Mockingbird	●	•	⬤	●	•	•	⬤	
High fidelity	justproto	●	⬤	●	•	•	●	●	Latter stage
	inPreso Screens	●	●	●	●	•	⬤	●	
	MockFlow	●	⬤	●	●	•	⬤	●	

4. Research on User Requirements

4.1 User Interview

User interview has been conducted for five designers who are doing service design practice to identify user requirements for developing mobile applications of service design prototyping tool. In the interview we have asked their co-creation experiences during service design process and gathered things required to carry out service design prototyping by using mobile based application. From the collected information, we have elicited user requirements which are applicable to future design work.

Table 4 User Interview

	**Interviewee**	Five designers working in service design companies.
	Interview items	Service design co-creation experience and service design prototyping experience
	Interview objective	To identity user requirements to develop mobile application

4.2 Elicitation of User Requirements

A result of the interview shows that there are many requirements on the efficiency of prototyping works and the usability of tools. There have been opinions that unnecessary things should be minimized and hassle of using various tools to do one work should be reduced. Among user requirements elicited from the user interview, elements which are applicable to the development of mobile application have been selected as follows.

Table 5 Elicited User Requirements

Elements	Description
High speed	Allows users to quickly make a prototype with basic functions while getting rid of unnecessary functions.
Real time	Allows users to conduct co-creation in real time.
Chatting function and file sharing	With this function, users are able to make prototypes and quickly share necessary files while chatting.
Scenario, scene, sequence of storyboard	By making scenarios and storyboards with scenes, users are able to identify overall prototyping flows.
Co-creation with participants	It allows coworkers to get various feedbacks by modifying and giving opinions each other.
Whiteboard function	Things which are difficult to describe by words can be expressed by drawings with whiteboard function.
Library	Visual elements for service design prototyping are provided for people participating in co-creation to use.
Drag and drop	With drag and drop function, participants in co-creation are able to place various icons and elements.

5. Mobile Application Design for Co-Creation

5.1 Concept of the Mobile Application

From the analysis of the case studies and the user interview, we have come up with design concept of mobile application for co-creation. This mobile application is a prototyping tool to be used in the early stage of service design process and allows users' quick communication with high speed, high adaptability, easier usability and low fidelity. For co-creation, it provides white board, file sharing function so various stakeholders' smooth communication and real time feedback is possible. Especially white board helps participants to communicate smoothly with others by expressing service concepts with drawings to them when there is no icon they can use in the library of the prototyping tool and when it is difficult to describe them in sentence.

Among methods which are used the most in service design, it provides functions specialized for service design by applying the methods of 'service role play', 'service prototyping' and 'story boarding'. Adding the elements of service design prototyping to basic functions of existing service design related prototyping tools makes it possible to reenact and test service situations which may be occurred during service design. In the library of the mobile application, it provides the icons of 'stakeholders', 'service objects' and 'service scape', which are basic components of service design prototyping. [7] The icons of stakeholders who are those related to real service are provided with various types such as occupation, age and gender. Those of service scape which is the place where a service is happening such as hospital bank and kindergarten etc. are also provided.

5.2 Functional Structure of the Mobile Application

The mobile application consists of the functions of 'library', 'edit', 'import', 'co-creation', 'view' and 'export'. The 'library' provides the icons of stakeholders, service objects and service scape and the edit function allows users to move and cut icons. It also can help users bring photographs and images which they took or saved, and bring templates made in open projects. With co-creation function, they can do chatting, reply to someone and use white board, which is useful to explain service concepts to somebody in drawings. View function is provided in 'list', 'thumbnail' and 'flow' form. Final result can be saved and shared in mobile device.

Table 6 Functional Structure

library	**edit**	**import**	**co-creation**	**view**	**export**
stake holders service objects service scape	move scale rotate	camera album template	chatting reply whiteboard	list thumbnail flow	share save

5.3 Prototyping Process

In order to conduct co-creation with the mobile application, after logging on it, users continue their project which they have been doing or open a new project. When opening a new project, they enter project name and decide whether they open or close it to the public. Then they add co-creators to it. After creating new scenes they are able to make prototypes with the functions of 'text', 'image' and 'library' and modify them with edit functions. Co-creators can also exchange opinions to scenes each other with 'reply' function, and conduct co-creation with 'chatting' and 'white board' functions and ask some co-creators to participate in the same scene for co-creation

when they are seeing other scenes or doing other works. If the scenes are gathered, it can be a story board. The story board can be saved in the form of PDF or sent via e-mail and shared with others by posting on Twitter or Facebook.

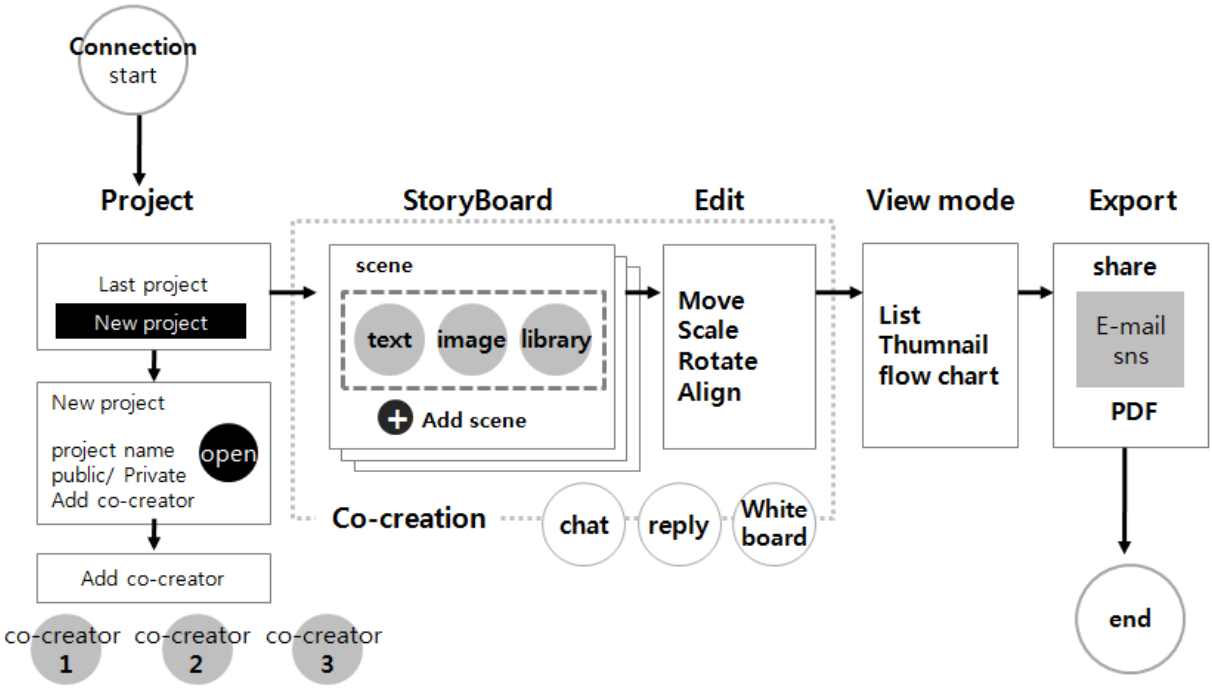


Figure 2 Prototyping Process

5.4 Wireframe

Prior to making a prototype for the mobile application we have made simple wireframes by using 'Wireframe Sketcher' tool. Wireframe Sketcher is a wire framing tool that helps designers and developers quickly create wireframes for desktop, web and mobile applications. [6] It has been used to briefly show the contents of the prototyping tool and to propose the structure of the mobile application. In the process of making wireframe shown in Figure 3, we are able to identify overall flow of prototyping and review ideas.

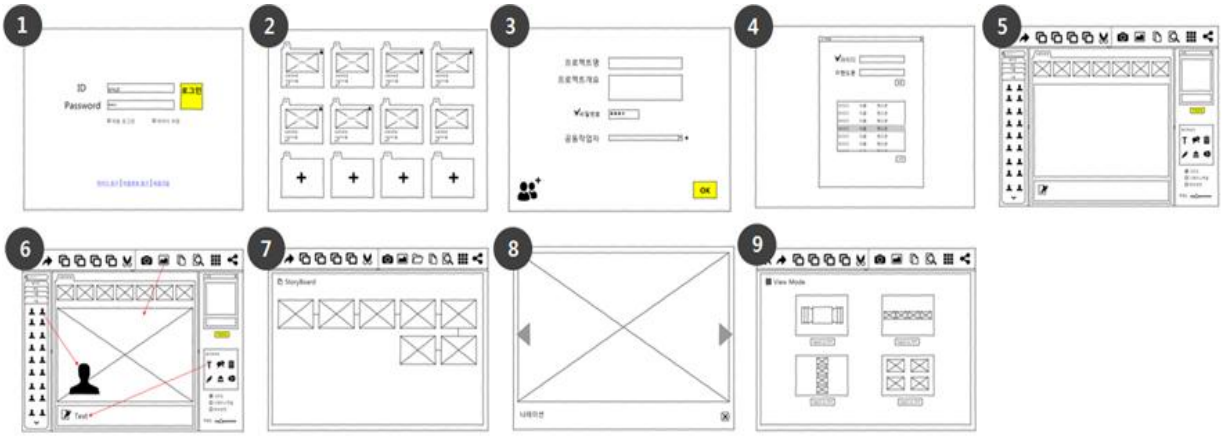
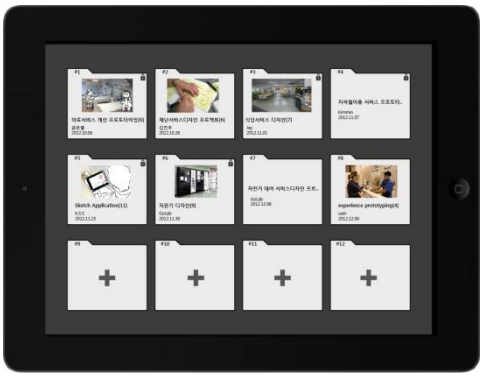
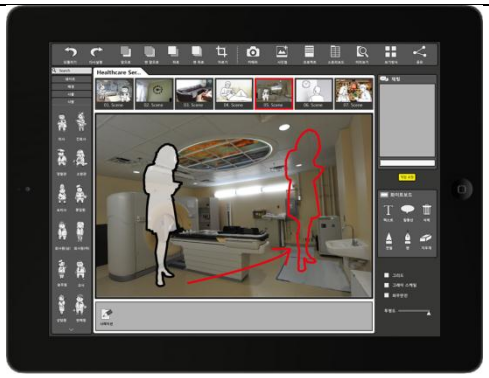


Figure 3 Prototyping wireframes

5.5 Mainframe

Based on screen structures made with wire frames, a main frame using graphic application program has been developed. Display size of the main frame is 1024 pixel by768 pixel, which is the resolution of i-pad. It consists of ‘window’, ‘button’, ‘icon’ and ‘text’ etc.

Table 7 Prototyping mainframe

Screen	1. project open and selection screen	2. new prototype main screen
Screen description	On this screen users are able to browse through projects or open a new project.	This main screen has ‘edit’ and ‘view’ function at the top. And ‘library’, ‘chatting’, ‘window’ and ‘white board tool’ at the left and right side and ‘text’ window to write scenario at the bottom of the screen.
Screen image		
Screen name	3. prototyping screen	4. storyboard view screen
Screen description	Elements on the library can be positioned in the middle of the screen and images brought from the album can be placed as background.	To show work flow, the screens in the process of prototyping can be arranged as thumbnail structure.
Screen image		

6. Conclusions

This study has been done to create a prototyping tool by which people are able to conduct co-creation whenever and wherever they want with mobile application. To do this, we have researched the cases of service design related prototyping tools. After selecting frequently used prototyping tools, we have used them in person and then analyzed their functions and features. As a result, we have realized that prototyping tool with low fidelity is appropriate to quickly make prototypes and does not provide as much components and templates as one with

high fidelity. Prototyping tool with high fidelity has many functions so it is good for sophisticated prototyping. We have also collected co-creation experiences and user requirements through user interviews on service designers. From the collected data, we have applied elements of high-speed, real time, chatting function, file sharing, scenario writing, whiteboard function, library, drag and drop etc. to the development of the mobile application.

By using insights elicited from the analysis of tools and user requirements, we have proposed a co-creation prototyping tool which can be applied to mobile application for service design prototyping. This low fidelity prototyping tool facilitates co-creation of stakeholders by providing quick communication, chatting and whiteboard functions with high speed, high adaptability and high usability. Through library it also provides icons of stakeholders, service objects and service scape and with the story board it makes users work in the order of scenario, scene and storyboard. To improve the prototyping tool, we will conduct a usability test on it and get feedback from users.

7. References

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