UX Improvement Framework for Large-Scale System Development

MORIGUCHI Masakazu, NODA Hisashi, KINOSHITA Tomomi, OOKAWA Hiroyuki

Abstract

Having realized the value of the UX (User Experience) that our customers can gain through our products and services, we at NEC have been developing new methodologies to enable users to apply their experiences to large-scale, advanced social solution systems while providing on-site support. As a result, we have achieved significantly improved operability and sophisticated quality, enabling us to offer products and services that can satisfy our customers. This paper discusses the UX improvement framework that has been created through this effort.

Keywords
user experience, social solution, on-site support, UX improvement framework, quantitative evaluation tool

1. Introduction

"Social Value Design" is a concept that aims at spurring innovation while maintaining a balance between individual and societal points of view by using Human-Centered Design and Design Thinking.

Accompanied by the advancement of the information society, complexity in systems is increasing, resulting in demands for simple, easy-to-understand operations. Meanwhile, the proliferation of smart devices has created an expectation for the same level of user-friendliness with various devices in workplaces and public places as well as with PCs.

Required also for the design of systems – those that help achieve a better and smoothly working society – are measures to prevent human errors that could lead to serious accidents and the drawing up of optimal solutions for society as a whole from the standpoints of diverse individuals.

These requirements are addressed by a concept of user experience (UX) that enhances the value of users' experiences from a human viewpoint when it comes to systems and services, as well as by a new methodology that applies that concept to social solution systems using advanced technology on a large scale.

This paper discusses a framework to improve UX for large-scale system development, developed by the Usability Engineering Office at VALWAY Technology Center, NEC Soft, Ltd. as a technology to support NEC's Social Value Design policy.

2. Tasks for UX Improvement in the Development of Social Solution Systems

Through efforts over many years to improve usability, we at VALWAY Technology Center, NEC Soft, Ltd. have been striving to train UX engineers on both organizational and project levels.

We recently launched the UX Innovation Strategy Office to announce the strengthening of R&D and on-site support and their incorporation into development processes to achieve Social Value Design.

Our UX engineers at the UX Innovation Strategy Office are engaging in the development of various systems, ranging from ordinary business systems such as work management systems used only by employees within a company to large-scale systems such as product manufacturing management systems involving a large number of personnel outside a company, with a

Table Examples of UX problems that occurred in a sales management system.

1. Individual problems	
(1)	There are various opinions about screen design, making it difficult to reach a final decision.
(2)	Documents are too voluminous, causing the design personnel to read them only partially.
(3)	Documents are interpreted differently, leading to displays that look different depending on the designers involved.
2. Teamwork problems	
(4)	Documents are too voluminous, making the review time available to design/standardization teams insufficient.
(5)	A screen utilization policy is approved while left unclear, resulting in delays in the investigation of screen standardization.
(6)	Although a screen design standard is adopted, the screens are not made according to that standard.
(7)	Screens are not uniform from one team to another.
(8)	Changes to documents are not thoroughly completed.
3. UX engineer problems	
(9)	Organizational restrictions, etc. do not allow for sufficient evaluation of existing systems.
(10)	Limited time makes it difficult to understand complex, wide-ranging operational details.
(11)	Insufficient explanation within documents results in frequent inquiries from design departments.
(12)	No decision can be made unless the design is approved, causing future inconsistencies with the tentative documents.
(13)	Insufficient understanding of the background and foundations of operations leads to an inability to judge whether or not customer requests can be met.
4. Effects due to restrictions	
(14)	Design approval leads to a significant range of changes to documents.
(15)	The efficiency and execution of certain operations are hindered by compliance with the system-wide policy.

view to improving the UX of each project.

There are already innumerable methods to improve the UX of projects. For example, a method called “Persona (hypothetical user models)” examines the potential needs of users; it is used to encourage empathy towards users’ situations among the people concerned. Another method called “Story Board” is used to create ideas to improve UX by letting users write stories of how they could be satisfied.

When these methods are applied to actual projects, however, there are many cases in which they do not work as intended. Listed in the **Table** are some examples of the problems encountered when efforts were made to improve UX in a sales management system development project for backbone operations.

The design of business systems varies among projects and the required UX differs depending on each project’s characteristics, including development scale and system structure. We offer frameworks for the improvement of UX to make it possible even for UX engineers with little experience to cope with a variety of such projects. Shown below are some of those examples.

3. UX Improvement Framework for Large-Scale System Development

We are constructing a framework to improve UX from the viewpoint of standardized operability and design while focusing on large-scale system development projects based on the waterfall development model, which can bring significant improvements, especially in cost-effectiveness.

In a large-scale system development project, the problems of individuals and teams, as shown in the Table, exert a substantial impact on the progress of the project. Unless each staff member can achieve results with a clear understanding of customer intentions, the development of a system that can satisfy customers will prove impossible. This can often be the cause of having to redo work.

Our UX improvement framework provides guidelines, templates and tools that are customized for particular tasks by systematizing a basic UX improvement process based on our UX engineers’ experiences with UX projects. Utilization of these makes it possible to efficiently understand the intentions of customers so that system development can be advanced free from unexpected reworking. These processes and tools are introduced in the following.

3.1 UX improvement processes

The first example of a UX improvement process is a standardized UI creation process, the outline of which is as follows (**Fig. 1**). In order to create UI standardization that reflects the intentions of customers, it is important to create a framework as soon as possible by identifying representative screens once the screens have been classified. At this point, it is necessary to consider the principles of usability as well as customer requirements and operation characteristics. While it is therefore indispensable to cooperate with staff members who are familiar with the system and its operations, contrivances are made to enable a user “persona” to be built by utilizing the templates and tools and minimizing process time and cost.

The next example is a standardized process for the creation of a screen design, the outline of which is as follows (**Fig. 2**). The way the screen looks depends on individual taste and preference, thus leading to a variety of opinions, which often make it difficult to reach a final decision. In order to establish a screen design standard that reflects the intentions of customers, it is important that the design concept be first clarified and then shared among all the members of the project. Subsequently, a prototype with excellent UX characteristics is prepared by a graphic designer and a consensus among all staff members involved is formed based on that. To improve the UX of a system, operability and at-a-glance viewability also need to be considered in addition to appearance; the guidelines therefore also specify creation methods for wireframes.

On the other hand, the compliance criteria of guidelines in past projects have been converted into numerals to help judge the priorities and risks that should be applied to the design of the processes in the project in question. For instance, as in problem (6) in the Table (“Although a screen design stan-

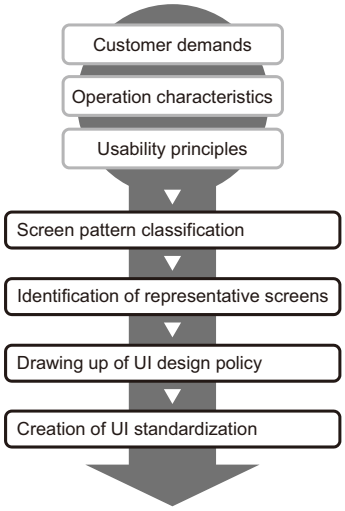

Fig. 1 Outline of standardized UI creation process.

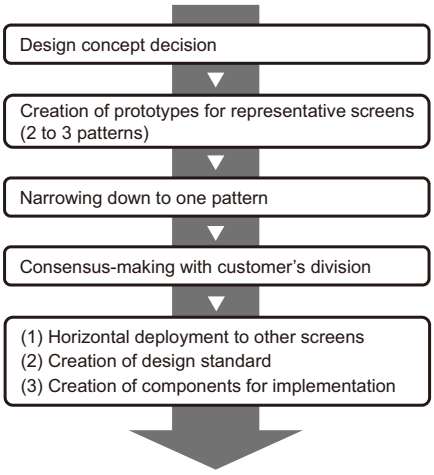

Fig. 2 Outline of standardized process for the creation of screen designs.

dard has been adopted, the screens are not made according to that standard"), it was found in some projects that 91% of the screens were not in compliance with the standard and an average of 4.03 UI elements in each screen did not conform to the standard. These figures are used when we decide on the priorities of the processes we are to deal with in each project. For example, with a high-risk project showing excessive non-compliance values, we assign a UX engineer to each team to check the compliance situations of all screens; on the other hand, with a project showing low non-compliance values, we resort to measures such as checking samples. In other words, these values are used as criteria for process selection.

3.2 Quantitative evaluation tool

The primary task for UX engineers is to clearly understand the details of operations and customer needs.

However, as listed among the problems pertaining to UX, it is difficult to understand complex and wide-ranging operation details in a limited period of time. Especially with large-scale systems, there are sometimes cases in which the number of screens exceeds 100, causing resources to be wasted on merely understanding the details of the operation.

There are also evaluation biases according to individuals; therefore, substantial reliability cannot be achieved by qualitative heuristic evaluation and walk-through evaluation alone. In particular, UX engineers with little experience may sometimes be incapable of identifying UX problems based on the actions of users.

To cope with these problems, we are conducting research and development on various tools. One of the most characteristic tools is a tool that logs and analyzes the operations and the actions of actual users to visualize UX.

This tool automatically evaluates personal factors such as users' usage frequency and hesitancy with the screen, which cannot be comprehended by the screen alone but only when user actions are observed. This tool is therefore useful to justify qualitative evaluation during consultation. It is also useful to support the understanding of needs during observation of user actions.

Fig. 3 shows an example of the visualization of an individual user's UX on the result registration screen of a manufacturing management system. The lines on the screen indicate the user's mouse movements and the circular spots indicate areas

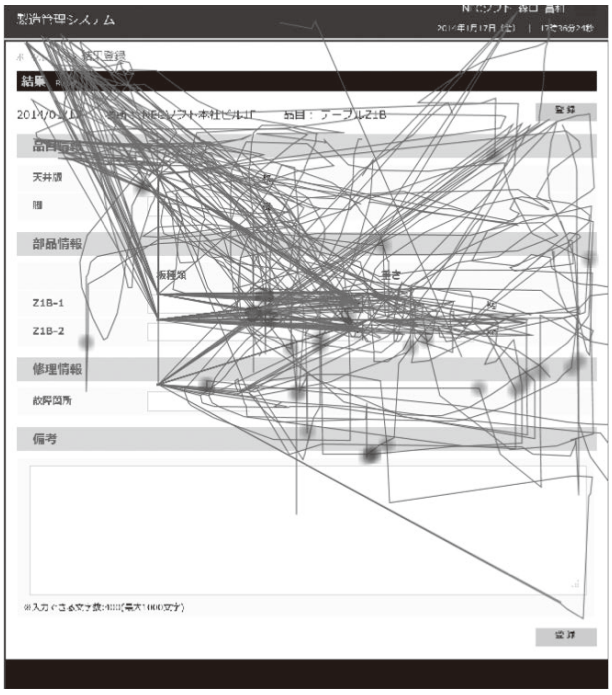

Fig. 3 Example of the application of the UX visualization tool.

detected to be the locations of special UX-related actions.

For example, this screen has three input areas: top, middle and bottom. This tool makes it possible to understand that only the middle area is mainly used. Because the circular spots here show that the user was forced to scroll excessively, it is possible to notice that moving the input area from the middle to the top can eliminate the need to scroll the screen and thereby improve the UX. It was also detected that there were users who paused the mouse pointer over certain terms until the tooltip was displayed, which makes it possible to notice that these terms were difficult for users to understand.

As we have shown, the use of quantitative evaluation tools enables UX engineers to become aware of experiences that could not be detected through conventional qualitative evaluation.

4. Conclusion

The current diversification of devices and designs and the advancement of customers' quality requirements are driving increased demand for UX engineers.

To improve UX, it is necessary to clearly understand customer intentions and to have the skills to achieve these intentions. That is why we are also trying to turn the UX improvement framework and UX visualization tool discussed above into sorts of textbooks, with a view to overcoming differences in experience between individual UX engineers to help achieve projects with excellent UX.

Innovation in business operations will be led not only by smart devices but also by new devices that have not existed before. We now also need to bring our attention beyond business systems and increase our commitment to social solutions such as for the Tokyo Olympics. We at the UX Innovation Strategy Office will achieve Social Value Design from our unique on-site viewpoint while continuing our efforts to support this field.

Authors' Profiles

MORIGUCHI Masakazu
Assistant Manager
UX Innovation Strategy Office
VALWAY Technology Center
NEC Soft, Ltd.

NODA Hisashi
Group Manager
UX Innovation Strategy Office
VALWAY Technology Center
NEC Soft, Ltd.

KINOSHITA Tomomi
Assistant Manager
UX Innovation Strategy Office
VALWAY Technology Center
NEC Soft, Ltd.

OOKAWA Hiroyuki
Skilled Expert
UX Innovation Strategy Office
VALWAY Technology Center
NEC Soft, Ltd.

* The stated titles and departments of the authors that appear in this paper are as of March, 2014.

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Vol.8 No.3 Social Value Design - Contributing to Social Value Innovations

Vol.8 No.3
July, 2014

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