

Establishing Human-Centered Design Process in Mobile Phone Development

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Fujitsu is improving the usability of mobile phones based on human-centered design that involves the research, development, and evaluation processes, as well as the strengthening of human resources. Third-party research and creating Persona in the research process, user testing and heuristic evaluation in the evaluation process, and training sessions for strengthening of human resources are a part of this effort. In the development process, we applied our method previously devised for Web development called the Scenario-Based Walkthrough method, which allows those not specialized in usability to easily conduct evaluation at the design phase. We also prepared a usability dictionary that contains case studies of usability problems found in various evaluations. Through these approaches, we established a sustainable human-centered design process, which led to the improvement of product usability. This paper introduces an outline of each process and gives specific examples of improvement.

1. Introduction

As of January 2009, the total number of mobile phone subscriptions in Japan exceeded 106 million, where most citizens own their mobile phones.¹⁾ In the process of such growth in the mobile phone market, mobile phones have gradually acquired more sophisticated functions such as compatibility with a variety of media including not only telephone and text messages but also the Internet. Besides, mobile phones have started to assume multiple roles including use as a camera, a JAVA-related device, an e-commerce tool and a one-segment broadcasting interface. Nevertheless, with the increased sophistication of mobile phones, the number of users not skilled in handset operation has increased. To address the needs of users who are not comfortable with complex operations, the importance of usability has increased. Survey results on customer satisfaction of users of mobile phones indicated that the operability of a mobile phone is an im-

portant index following its design and quality.²⁾ These results are supported by the fact that the operability-focused Fujitsu Raku-Raku Phone Series has achieved total sales in the order of 10 million units.³⁾ This implies that the development of mobile phones with high usability will lead to an improvement of product competitiveness.

Therefore, Fujitsu, Fujitsu Laboratories and Fujitsu Design (FDL) have promoted a joint initiative to establish a human-centered design (HCD) process to develop products with high usability. This paper introduces an outline of each step of establishing an HCD process and gives specific examples of improvement.

2. Approaches to HCD process

To develop products based on an HCD process, our approaches addressed four primary areas comprised of research, development, evaluation, and strengthening of human resources

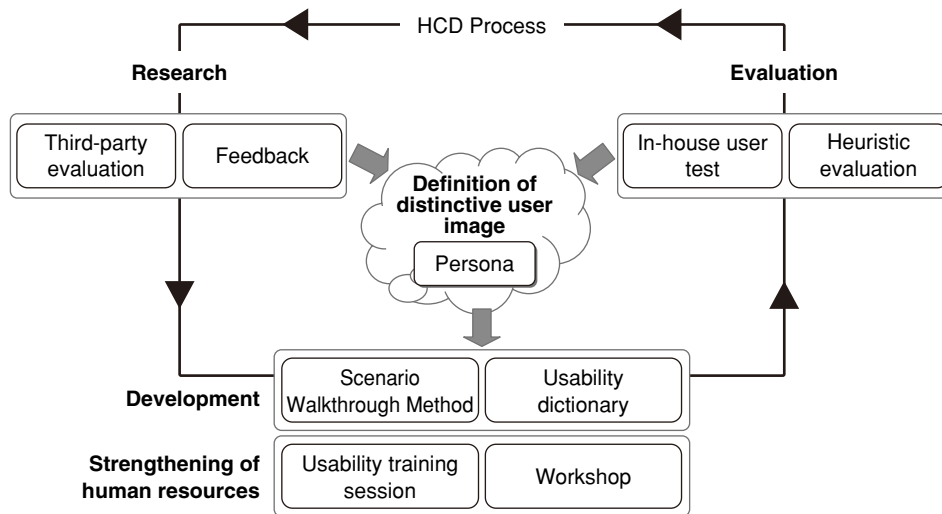


Figure 1
HCD process.

(Figure 1).

2.1 Approach in research process

As a starting point to improve usability, it is essential to understand the current status of a product. In addition, understanding the needs of users is also imperative. Therefore, our research process incorporates user tests by third parties, analysis of feedback from users and the creation of Persona.

1) Third-party research

As a method of understanding the current issues, we adopted user tests by third parties and evaluations by usability engineers. As part of the current approach, we commissioned third-party research on the primary functions of some of Fujitsu's mobile phones (F903i and F905i) to identify the challenges to be addressed.

Concerning the research on F903i, 42 users from the estimated main cluster were asked to carry out tasks using its primary functions including its text messaging and telephone directory functions. Based on observations, errors during the operations were identified and interviews with the users were conducted to understand their level of awareness about using the mobile

phone.

By implementing this third-party research, we were able to clearly identify issues and the developers of these functions could objectively understand how much the users were comfortable with using the phone's functions. This approach helped increase developers' motivation for further improvement.

Further, by employing a priority system for the issues identified in the evaluation depending on their importance, we were able to improve those issues that had a higher priority first, which led to the solution of a larger number of problems.

2) Feedback

In addition to the third-party research, information regarding feedback from users and from points of sales after product shipment is also important. This feedback reflects the perceptions of users who actually use the products. Together with the results of the third-party research, we appropriately consider this feedback when developing improvement measures.

3) Persona

We used Persona to ensure that the user interface (UI) design is not dependent on the skill of the developers but on the actual way a product

is used by the users. Persona is the concept of a hypothetical user. While the Persona itself is a hypothetical character, it represents a typical user developed based on a database.⁴⁾

Normally, the use of the Persona can be considered in two phases: it is used when defining functional requirements; and it is used when designing and verifying the UI. In the current approach, we use it only in the UI design and verification phase.

We produced a "Persona Book" describing a Persona created based on marketing research and in-depth interviews. Developers used this Persona Book to understand the users in detail, together with their lifestyles and tastes, and the UI was then designed based on this perception of the users.

Then, through the evaluation of the UI designed in the aforementioned manner by assuming a situation where the designed UI was used by the Persona, its operability was verified at an upstream level.

By using the Persona, we can clearly identify design guidelines and it has enabled us to make timely decisions.

2.2 Approach in development process

Aiming to develop products whose usability is taken into account by developers themselves, we devised a method that ensured products easy to use by even those not specialized in using them during the development phase.

1) Development of Scenario-Based Walkthrough method for mobile phone versions

A methodology called Scenario-Based Walkthrough method⁵⁾ previously developed for Web development by Fujitsu Laboratories was enhanced for mobile phone development. This Scenario-Based Walkthrough method is based on implementing a series of procedures from scenario development through to the Walkthrough Evaluation to allow us to verify a phone's usability at the development phase among people who are not usability engineers.

The points to enhance for mobile phones were an improvement in the format for creating scenarios that ensured usability of even multi-function products as well as the development of Walkthrough evaluation points reflecting the limitations inherent in software and hardware of mobile phones.

Further, we described a supplementary method such as a procedure to create a paper prototype for verification and recorded it as a manual.

2) Usability dictionary

A usability dictionary is a document that summarizes case studies for usability problems identified in user tests and heuristic evaluations. By using keyword search functions, developers can find relevant cases that have arisen in the past. This method is effective for preventing recurrence of similar problems during the development phase.

2.3 Approach in evaluation process

To evaluate functions that were improved, in-house user tests were combined with heuristic evaluation.

1) In-house user test

It is difficult to use third-party user tests for functions that are still in the development phase because deficiencies are observed frequently in each process of finalizing specifications. Therefore, simplified in-house user tests on functions are implemented by employees other than those in the Development Division. The problems pointed out in the in-house tests can be used effectively as inputs in development.

2) Heuristic evaluation

If there is no time for in-house user tests because of the development schedule, heuristic evaluations by usability engineers such as the authors and FDL's staff responsible for usability are carried out to identify the points requiring improvement. This engineer evaluation has an advantage of offering timely feedback for improvements, because engineers and developers

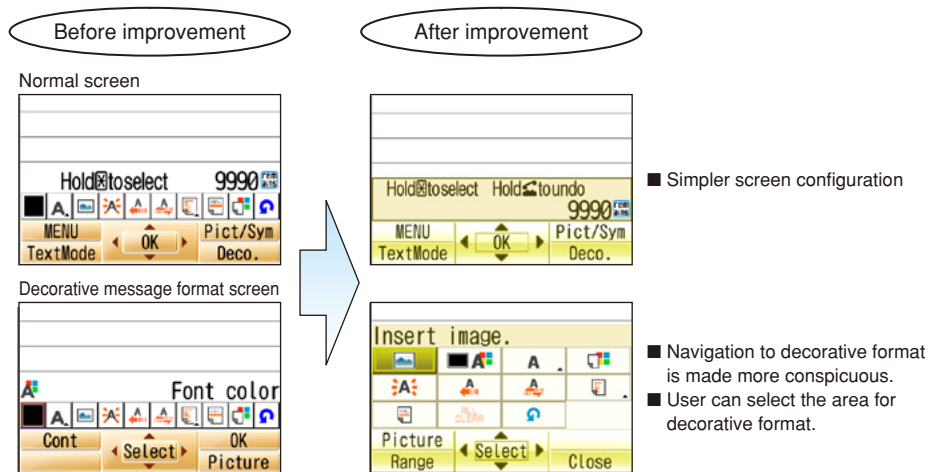


Figure 2
Improving text message function.

can have consultations on the improvement proposal after the evaluation.

2.4 Approach in strengthening of human resources

Various measures are implemented to enhance awareness for usability among developers as a whole.

1) Training session

A training session for usability is divided into two phases (basic course and drill course). The main contents of the basic course are lectures on the basic concepts and benefits of usability. Participants per session exceed 100 people and additional lectures are held for those who could not participate in the primary session. The drill course is a small group session, where proposed improvements for specific applications are examined based on the Persona and scenarios. This approach is effective in enhancing awareness and skills for usability.

2) Workshops

Other than training sessions, small-group workshops for usability are held to develop usability engineers. The lectures given by the lecturers including the authors allow participants to acquire general skills as usability engineers by studying versatile areas related to usability such

as cognitive science, psychology and ergonomics.

3. Usability improvement

The following are typical examples of usability improvement cases:

1) Improvement of text messaging functions

The issues pointed out by the third-party research regarding the text messaging functions were improved.

Particularly, the improvement of creating a deco-mail (a text message with a decorative template) was achieved because of its high priority. Challenges to be addressed were identified by third-party evaluation and the Scenario-Based Walkthrough method, followed by designing based on key scenarios according to the Persona. There are various limitations in actual development. However, by creating a Persona and developing a design based on the scenarios, we could establish improvement measures by clearly identifying the limitations for which we could compromise and those that should be overcome (**Figure 2**).

Further, by developing a paper prototype based on the proposed improvement, we evaluated products by the Walkthrough method to verify whether the planned usability was ensured.

2) Security (fingerprint registration)

The method of fingerprint registration was

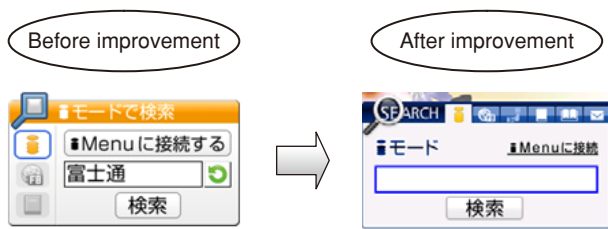


Figure 3
Improving search function.

also cited as a challenge to be addressed in the previous user tests. While the fingerprint registration function is one of the appealing points of Fujitsu's mobile phones, some people failed to register their fingerprints because they could not understand the registration method. To overcome this issue, we made several improvements including a change in the registration procedure, the adoption of an animation instead of the current illustration as an explanation, and a change in the method of presenting explanations and supplementary information. In this way, we improved the prototyping using a Flash based on the third-party research results as well as the simplified evaluation using the paper prototype for further refinement of the specifications. Besides, we verified the usability of a mock model as an embodiment of the proposed improvement in in-house user tests to gauge the level of improvement achieved. As a result, the success rate of the fingerprint registration task rose drastically to 90 percent from 40 percent.

3) Search

The search function is a new function initially adopted in F906i. By using a newly-introduced search button, multiple types of searches such as an i-mode search, Google search (via a full browser) as well as searches in a map application, dictionary, telephone registry and text messages are available. In improving this function, we created a paper prototype which served as the basis for refinement of the specifications. Although we found several problems with the initial proposal, we were able to produce a very simple operation

system in the end by solving them one by one (**Figure 3**). Also, closer communications between developers and designers using a paper prototype allowed us to achieve more persuasive and refined improvement proposals that were supported by new ideas, and allowed each party concerned to contribute to the development in its area of expertise.

4. Future challenges

We successfully established an HCD process through a series of approaches comprised of research, development, evaluation and human resources reinforcement. Further, we verified the increased usability of functions through the improvements.

In future, we must actually operate the HCD process we established through the aforementioned approaches and make improvements to reflect the results of future developments in products. The scope of the improvements and processes hitherto implemented were the review after the establishment of the functional requirements. However, to develop functions while giving consideration to usability, we need to have design activities from the upstream processes including the functional requirements. Therefore, to enable function design while giving consideration to usability from the planning phase, we need to increase our involvement in the upstream processes so that we will be able to improve more functions to improve the usability of the mobile phone as a whole. Besides, it is also important that we reduce the period of reviewing improvement proposals, because formulation of the proposed specifications may take several months from the research phase to the formulation of a feasible specification proposal in the case of reviewing proposed improvements of multi-function applications such as text messages. This is because of the diverse fields that need to be reviewed.

Further, a review of the UI that reflects compatibility with Web-based services is necessary giving consideration to the future trends of

increasing tie-ups with Web-based services, although the current functions are dedicated solely to the internal contents of mobile phones.

5. Conclusion

We made a substantial achievement in the improvements of usability and processes as joint efforts of Fujitsu, Fujitsu Laboratories and Fujitsu Design.

Further, by mutual collaboration of developers and usability engineers through a series of approaches, it was possible for both parties to absorb new know-how for development of usability-focused products.

A contributing factor to the success of the current initiative was the fact that usability engineers were involved in the development process and made collaborative activities.

Decision making by the top management is essential for developing easy-to-use products. Another success factor in the current initiative was the promotion of usability-focused approaches as a top management policy in mobile phone

development.

The Fujitsu team is eager to continue enhancing approaches for usability improvements to create more competitive products supported by high customer satisfaction.

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