Application of Hypothesis Verification to Software Development for Photo Products

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Abstract

Generally in the photo market, customers have specific personal memories about their photos to be printed. We took this into account in verifying the usability of our online photobook ordering system. We adopted a well-known hypothesis verification method and improved the verification process by using testers' own photos in the designing and ordering of a photobook, and printing them in the final product prototype. This approach successfully met the customer needs more accurately.

1. Introduction

Generally speaking, a problem that may sometimes arise during the development of a software product is that too many specifications are given to the software, so that despite the increase in the time and cost required for development, the resulting product does not meet the needs of the users. This problem with specifications is likely due to demands being made for the product that are largely subjective, seeing the product as though it were a person, or that are ad hoc and not well thought out. Specifically, the following are the major issues in the specification requirement phase:

1) Narrowing down Requirements

The true needs of the users are not identified. Every function that might be useful is demanded, and there is an excess of specifications.

2) Obtaining Evidence that Supports the Requirements

The appropriateness of a requirement is not based on valid, objective evidence. The specifications are constantly changed according to the opinions of many people.

What is important in working on these two issues is to collect data based on objective evidence efficiently in a short period of time. It is known that, in order to grasp the needs of the users quickly and to make specifications in an efficient manner, the “hypothesis verification process” is beneficial, where, instead of going through all the possibilities exhaustively, the possibilities are narrowed down using a “guess”, and an issue is identified by verifying the guess. In general, the hypothesis verification process consists of repeated application of the following three phases: (1) observation and analysis of the situation, (2) making a hypothesis, and (3) verification of the hypothesis. In the case of software development that uses user interfaces (GUI, hereafter), the verification is done using software prototypes (Fig. 1).

![Fig. 1 Hypothesis verification process for GUI software development.](image)

However, in our case, we are targeting software development in consumer photo applications for an online photobook production system, where the usual hypothesis verification process for GUI software development cannot be applied because of the characteristics specific to photographs. Therefore, we improved the hypothesis verification process to be suitable for photography applications, and applied and implemented it to the software development of the photobook production application.

In this report, we describe the characteristics specific to photographs in Section 2, problems with the hypothesis verification process for GUI software development in Section 3, the solutions to these problems in Section 4, and the “hypothesis verification process for photography applications” that we implemented in Section 5. Then, we discuss the result of the application of our process in Section 6, and show the conclusion and outlook in Section 7.
2. Characteristics Specific to Photographs

Photo-related products including photobooks give shapes to users’ memories, and have the following characteristics:

(1) Each User has Different Feelings toward Every Single Photo

Each of the users has a different perspective on a photo. Photo-related products involve users’ feelings and the value of the product varies depending on the photos used in them.

(2) The Products Contain Photos Taken by the Users

Unlike other generic consumer products such as cameras or bags, the final products contain photos taken by the users. The final products are different for each user.

3. Issues in the Hypothesis Verification Process for GUI Software Development

When the usual hypothesis verification process for GUI software development is applied to the development of photo product applications such as online photobook production, problems like the following arise in the verification phase due to the characteristics we explained in the previous section (Fig. 2):

(1) Valid Evaluation of the Product is Impossible When Data Used Do Not Have Any Personal Attachment

Evaluation of function and operability using test data by users is not valid when the user has no personal feeling toward the data. For instance, evaluation of whether the operation “selecting your favorite photos” fulfills the user’s desires is pointless if the user has no feeling for the data in the first place.

(2) Valid Evaluation with Software Prototypes Only Is Impossible

In the photo application field, the software is not the final product. The users cannot obtain the impressions of the final products from software prototypes and there is no way for them to know what functions and operability are provided with the product, which makes it impossible to give a valid evaluation.

4. Solutions to the Issues

As solutions to these issues, we introduced the following two changes in the verification phase (Fig. 3):

(1) Use of User Data

Data of photos taken by the user are used in the verification so that the user can have a real feeling during the verification.

(2) Use of Product Prototype

Product prototypes of the final product that allow the user to confirm what will be actually obtained are produced. This makes all-around evaluation possible by providing associations between the final product and the impressions of the functions offered.

5. Realization of a Hypothesis Verification Process for Photography Applications

5.1 Overview of the Process

In the hypothesis verification process that we used in this study, we incorporated in the hypothesis verification phase the two solutions described in the previous section, and at the same time, for the purpose of quick specification narrowing, we also introduced a step for clearly determining the target in the situation observation and analysis phase (application of the persona method3), and a step for road map drawing in the hypothesis creation phase, which resulted in dividing the three phases into five steps (Table 1).

<table>
<thead>
<tr>
<th>Table 1 Initiated process.</th>
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<tr>
<td><strong>Usual process</strong></td>
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<td>(1) Situation observation and analysis</td>
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<td>(2) Making hypotheses</td>
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<td>(3) Verification of hypotheses</td>
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Fig. 2 Challenges for software prototype in photo products.

Fig. 3 Solutions to challenges.
5.2 Process Details

5.2.1 Step 1: Situation Observation and Analysis (Target User Identification)

It is clearly determined what is to be provided to whom. The profiles of the target users are identified so that their images can be shared. Specifically, we used data of the target users, ranging from their basic information (age, gender, occupation, etc.), to more detailed information (family structure, hobbies, life styles, etc.), their photograph-related activities (the number of photos taken by the user per month, storage method, etc.) and so on, to obtain clear images of them to be shared.

The key is to have a clear picture of the target users.

5.2.2 Step 2: Making the Hypotheses

The problems are identified and the hypotheses for solving them are set. Specifically, issues to be resolved in designing a photobook (such as selection of photos out of huge collections of photos, time consuming work required for finding a satisfactory layout) are identified, and hypotheses for making the photobook designing process easier are made.

Since verifying all the hypotheses requires a huge amount of time and effort, it is important to rank them for priority, plan the steps of a lengthy solution strategy, and create a roadmap of items to develop and verify.

5.2.3 Step 3: Concretization of the Hypotheses (Prototype Development)

The concrete steps of the solution strategy were made clear, and the items to be verified were narrowed down. Specifically, we developed software prototypes for the purpose of confirming the function and operability, and product prototypes for the purpose of associating the product with images of satisfaction it brings and the functions provided.

In software prototyping, it is vital that the items to be verified are narrowed down, for the sake of obtaining the verification result quickly, and that product prototypes are made that allow confirmation of the effect of the provided function.

5.2.4 Step 4: User Verification

The solution strategy that is created based on the hypotheses was verified. Specifically, we observed the users operating a software prototype containing their own data, while looking at a product prototype.

It is vital to use the data of the users. Otherwise, the users are not able to have real feelings when they use the prototype and the user’s impressions are insignificant.

5.2.5 Step 5: Re-examining the Specifications

Based on the results of verification, the specifications were reexamined. After the verification by the users was completed, the developers simulated the behaviors of the users to confirm the validity of the verification results. When the results were not satisfactory, the hypotheses were changed and used in the next verification (one such example is the method for displaying failed photos during the photo selection).

The more time passes after the verification, the more the mindset of the developers dominates over that of users. Therefore, it is important to reexamine the specification while the verification results are fresh and new.

6. Result of Applying the Hypothesis Verification Process

The result of applying the process described so far to the software development of a photobook production system is as follows.

6.1 Effects of Use of User Data

By using the actual data of the users, it was possible for the users to have serious interest in the system, which helped us determine the desirable method of use and functions and also discover some potential needs of the users, benefits for which we did not make hypotheses (an example of this is the way to display failed photos). Moreover, we could obtain supporting evidence for the hypotheses, which contributed to making suitable corrections of the hypotheses based on the verification results (Table 2).

<table>
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<th>Table 2: Number of hypothesis at each cycle.</th>
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<tr>
<td>Total number of hypotheses</td>
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<tr>
<td>Verified hypotheses</td>
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<tr>
<td>Corrected hypotheses</td>
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<td>Discarded hypotheses</td>
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Evaluation room
Observation room

Fig. 4 User validation methodology.
There were four hypotheses (some were discarded) in the verification of UI and device operation features in the first cycle and four hypotheses (some were discarded) in the verification of function in the second cycle that differed greatly from the actually obtained evidence, but in the third cycle all of the hypotheses were verified.

6.2 Effects of Product Prototyping

By presenting to the users both the function and the finished product at the same time using the software prototype and the product prototype, the users could understand how a function of the software would be reflected in the actual product, which helped them make valid evaluations. For example, in the case of the function for displaying all the dates that the photos were taken, the users were not particularly impressed with it in the software prototyping verification but when they saw it in the product prototype, almost all the users said that they wanted the function. This is a hypothesis that would have been mistakenly verified with software prototyping only. Moreover, by obtaining the impressions of the final product using the product prototype, it was possible to confirm the needs of the users regarding the use and cost of the product.

6.3 Evaluation Result in the Market

The functions that were evaluated highly in the verification (such as the automatic layout function) were introduced in our online ordering web sites, and the satisfaction with this function was surveyed before and after the introduction.

The proportion of the users satisfied with the results of automatic photo layout was increased by 24 points, indicating that the introduction of the function was beneficial.

7. Conclusion and Outlook

In this report, we established a new process for applying the general hypothesis verification process for GUI software development to software development of a consumer photo application, an online photobook production system, and by applying this new process to the actual development project, we successfully obtained better understanding of the needs of the users. In the future, we aim to refine this process by applying it to more real projects, and so to contribute to the development of functions which have true value to users.

References

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