A Method for Creating Persona Using Bayesian Network Analysis

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Abstract: General method which allowed us to understand the target user was based on the graphs or tables using the distribution or average value of the research data. However, each person in charge of the processes in the development had often different imagination of target user, because of the difficulty of understanding the graphs or tables. So, persona method is focused on a method to present the imagination of the target users specifically. The virtual user or virtual users are created out based on the research data of target users. However, in the traditional persona method, there was a problem that the success of creating a persona depends on the skill of persona creator. In this study, we proposed a method for creating personas using the Bayesian Network Analysis, which allowed us to express the persona including not only the value of research data but also the causal relationship between the data. Moreover, the proposed method is not influenced by the skill or experience of persona creators and is most likely automated by adapting the persona template, REAS and Bayesian Network Analysis. We also validated the proposed method and evaluated the persona created by it.

Key Words: Persona, Target user, Bayesian network analysis, causal relationship, REAS, Human-centered design.

1. Introduction

In recent years, various products and services have been developed to correspond the needs of wide variety users. General method which allowed us to understand the target user was based on the graphs or tables using the distribution or average value of the research data. However, each person in charge of the processes in the development had often different imagination of target user, because of the difficulty of understanding the graphs or tables. Due to the different imagination in a development team, the development process often became inefficient.

Persona method [1]-[3] is focused on a method to present the imagination of the target users specifically to the development teams. The virtual user or virtual users are created out based on the research data of target users who are actually using the considered products or the service. The virtual user is called "Persona". The contents of the persona are profiles including name, gender, age, job, family configuration and face picture, and text describing the daily life and change of mental state. Rather than the graphs or tables of the users’ data, the persona method can be offered more specific imagination of the target user to the person in charge of processes in the development. Moreover, this method has been used as one effective method in Human-centered design [4]. However, there is no specific definition of procedure for creating persona, and the degree of completion of the persona depends on the skill and experience of the persona creator.

In this study, we propose a method for creating personas using the Bayesian network analysis. By using the Bayesian network analysis, we consider that the persona can be expressed by not only the value of research data but also the causal relationship between the data. Moreover, proposed method is not influenced by the skill or experience of persona creators and is most likely automated.

This article is based on the preliminary experiments and results reported in a conference paper published in the Proceedings of 2013 International Conference of Biometrics and Kansei Engineering (ICBAKE 2013) [5]. We extended the work by investigating the persona method and the released persona by companies and universities. Based on this investigation and the preliminary experiments and results, we proposed the steps of the method which was not mentioned in the conference paper and was not used in the conference paper as well. Therefore, the present study reports a new aspect of the method presented in the previous conference paper. Furthermore, extensive evaluation has been conducted to validate the effectiveness of this method. The extensive evaluative results demonstrate the effectiveness of the proposed method.

The present study is organized as follows: in Chapter 2, a literature review is summarized; in Chapter 3, the steps of our proposed method is described in detail; in Chapter 4, the results of our evaluation are discussed; and in Section 5, our conclusions are summarized.

2. Literature Review

Persona was proposed by Cooper [6] and was developed for the product designer to visualize and connect emotionally to the target user. The virtual user "Persona" is created based on the data of target users and should not be based purely on the creator’s imagination. There is no definite procedure to make the persona. However, the below four steps are considered as common procedures:

Step 1: Clarify the objective of making a persona
Step 2: Collect user data
Step 3: Analyze user data and understand the results
Step 4: Make a persona
The most steps are decided by discretion of the persona creator. The underlying factors for the decision for persona creators are the presence or absence of experience of creating persona, work experience, creator’s sense and personal character. Then, different persona is created using same data of the target user. The success of creating a persona depends on the effectiveness of creation of the persona creator itself. Miaskiewicz [7] also said that personas are only one way of understanding users but they are sometimes viewed as too subjective. From these backgrounds, it is the most difficult point that the effective persona is created by anyone.

Present day, the persona method has been used most of Japanese companies. For example, Fujitsu [8] made personas who are an elementary school student, her mother and her teacher for the development of web contents for children. In the persona of elementary school student was composed by the basic information including name, age and family configuration, personality and the text describing the specific scene of using her computer and daily life. Based on the research of upcoming personas by companies and universities [8]-[12], most of persona has two points as common basic characters. The first is basic profile, and the second is scenario. Moreover, the scenario is divided into two types; scenario focusing on the daily life and scenario focusing on the scene of using the considered products or services. These tendencies are also confirmed in the research by Kuniavsky [13].

3. Methodology for Creating Persona Using Bayesian Network Analysis

Based on the investigation and the preliminary experiments and results [5], we propose the below four steps to create a persona.

Step 1: Make a persona template
Step 2: Make a questionnaire and collect user data
Step 3: Apply the results from Bayesian Network Analysis in the persona template
Step 4: Complete the persona

Step 1, 2 and 3 are mostly influenced by creator’s experience and skill. Therefore, in this study, these steps are likely automated by adapting the persona template which is proposed in the current study, REAS [14] which is the web-based questionnaires and Bayesian Network Analysis [15]. Step4 is conducted manually like the conventional method. Step1, 2 and 3 are specifically explained below.

3.1 Make a Persona Template

The persona template is a so-called “frame of persona” and is proposed in this study. Based on the concept of the products or services, the persona template is composed by the profile part and scenario part which have many blanks corresponding to the characteristics of the target users. Most of these blanks of the persona template is also corresponding to the question items from the questionnaire and is filled by the results of Bayesian network analysis. An example of the persona template is shown in Section 4.1.

In this step, the persona creators will be required some skill and knowledge to create the persona template. However, it is considered that the skill and knowledge to create the persona template are as same level as to create the common questionnaire. In an actual use, we will propose that a company has its database with the set of persona template and questionnaire, therefore, persona creators can easily create persona by remaking or adapting the set of them matching to the concept of development.

3.2 Make a questionnaire and collect user data

As described in Section 3.1, the questionnaire is made corresponding to the persona template. Most of the question items are composed to fill in the blank of the persona template. Through the preliminary experiment [5], we found three checkpoints to make the question items.

1. Should have a choice of one answer only for each question.
2. Should not use free description.
3. Non-response is not allowed. An answer for each question is a must.

The example of the items of question is shown in Section 4.1. In order to correct the research data of the target users, we adopted the REAS which is web-based questionnaire. By using the REAS, the workloads of correcting and analyzing the data are decreased.

3.3 Apply the results from Bayesian network analysis in the persona template

We used Bayesian network analysis to analyze the research data of target users. The Bayesian network [15] is a probability model that shows the qualitative causal relationship between factors as a directed acyclic graph, and shows the quantitative relationship as conditional probability.

In order to know the specific circumstances of using the products or services by the target users, developers have to know not only the events that can be readily determined from the research data, but also the causal relationship between the events. The causal relationship can show that the persona’s story is more likely a real life one and personas are more like a real person. Moreover, the different results of the Bayesian network can be predicted by the operation of the random variables. So we can easily create different personas from different viewpoint using same data.

For the Bayesian network analysis, we used an analysis software (BAYONET [16], NTT DATA Mathematical Systems, Japan). The answers of the questionnaire are inputted to the BAYONET, and the probability value of each event and causal relationship are shown as the results of Bayesian network. Each node (event) in a Bayesian network represents a random variable, while arrows between the nodes represent the probabilistic dependencies among the corresponding random variables.

In the BAYONET, the Greedy Search is used for making the optimal links and a threshold which is a value of cross-tabulation table can be changed. By changing the threshold, the number of links can be also changed. Generally, if the number of input data for Bayesian network analysis is too small, the threshold should be changed. However, the default value of the BAYONET was used in our study.

The state of the maximum probability of each event is filled in the blanks of the persona template, and new sentences are described based on the casual relationship of Bayesian network and inserted the related part of it. A specific example is shown in Section 4.1.
To avoid unnatural expression of the persona template, the results of the Bayesian network analysis is filled in the blank of the persona template by the persona creator. In this step, the minor change of the expression of the persona template is allowed based on the results of the Bayesian network analysis.
4. Validation of the Proposed Method

We validated the effectiveness of the proposed method and evaluated the persona created by it.

4.1 Creating a Persona of a University Student

Step 1: Make a persona template

As mentioned in Chapter 2, the scenario is divided into two types. We created the scenario which focus is on the daily life. Specific content of the persona template is “A daily life of the student from Tokyo Metropolitan University”. The created persona template is shown in Table 1 which is the weekdays’ version. For the items of “Getting up/Going to bed” and “Eating”, there is another set of sentences for weekends.

Step 2: Make a questionnaire and collect user data

Most of the question items are made corresponding to the persona template of the university student. The created questionnaire of the weekdays’ version is shown in Table 2 and Table 3. There is also another questionnaire for the weekends’ version. The answers of the questionnaire were obtained from 52 university students (20-23 years old) by the REAS.

Step 3: Apply the results from Bayesian Network Analysis in the persona template

From the result of Bayesian network, a part of network was extracted by considering suitable for the persona like Figure 1. The results of the Bayesian network analysis show only probabilistic relations, therefore, it is sometimes difficult to read off the interpretation from the part of the links. In other words, it is occasionally impossible to get an information for the persona from the part of the links. In the current study, those links were deleted manually, and the remaining links is shown in Figure 1. In this manual operation, it might be considered that some subjective decisions of the persona creators are needed. However, deleting the links is practically quite a simple and mechanical operation.

The characteristics of the university student as the causal relationship were read off from the Bayesian Networks of (a), (b) and (c) in Figure 1.

(a) If a student eats dishes with rice cooked by himself for dinner every weekdays, he always eats breakfast in the weekend.

(b) If a student is male, he eats dishes with rice bought by himself for lunch.

(c) If a student goes to club activity during his free time, he goes to his university by train and bicycle.

By the operation of the random variables, we could predict the below different results (a’), (b’) and (c’) corresponding to (a), (b) and (c).

(a’) If a student eats dishes with rice bought by himself for dinner every weekdays, he doesn’t eat breakfast in the weekend.

(b’) If a student is female, she eats dishes with rice cooked by herself (lunchbox) for lunch.

(c’) If a student doesn’t go to club activity during his free time, he goes to his university by bicycle.

The persona template that applied the results from Bayesian Network Analysis is shown in Table 4 (the weekdays’ version). The underlined italic words are the states of the maximum probability of each event. Bold words and sentences were obtained from the causal relationship of Figure 1. And the sentences enclosed in parentheses were predicted by the operation of the random variables.

It is considered that the persona was expressed by sentences not only expressing simple states but also expressing reality based on the causal relationship. From the results of the persona template, it is considered that the proposed method is possible to create a persona and the persona is appropriate and presumable.

The name and photo of the persona has not been added yet, since the scenario of the persona has been should only be evaluated as mentioned in Section 4.2.

4.2 Evaluation of the University Student’s Persona

The persona created with the proposed method (the weekdays’ version of Table 4 and the weekend’s version) was evaluated by 20 students from Tokyo Metropolitan University who were the actual target users and were not the same students mentioned in Section 4.1. They had the knowledge that the persona is used for the design of products and services and knew that the target of evaluation is a persona which is a virtual university student. A persona doesn’t have only one correct answer, so it is difficult to evaluate the persona by only indicating it to the evaluators. Therefore, the persona was evaluated by two evaluation questions: “(1) Dose the persona belong to a university student from Tokyo Metropolitan University?”, and “(2) Has proposed persona achieve the released persona?”. Each item was evaluated on 5-point Likert scale. On the question (1), from the view point of the expression of personality of the target user which is the
most important element, the persona was evaluated as an absolute evaluation by the actual target users. On the question (2), the released personas by the companies or the university [8], [11], [12] were also shown to the evaluators as ideal personas for a comparative evaluation.

The results of the evaluation is shown in Table 5.

With regard to the result of question (1), we could get high scores which are considered as the positive results in the absolute evaluation even though the evaluators were the actual target users. Moreover, there were many comments that this persona considerably likes the student of Tokyo Metropolitan University. On the other hand, the result of question (2) was intermediate in the comparative evaluation. It was caused by the emotion of the persona that was not expressed in the current scenario. Generally in the released personals by companies, scenarios include expressions of persona’s emotion. It remains as a future subject.

From the results of the evaluation, although the future subject remains, it is considered that our proposed method can create the persona expressing the target user sufficiently.

5. Conclusion

In this paper, we proposed a method for creating personas using Bayesian network analysis. In the traditional persona method, there was a problem that the success of creating a persona depends on the skill of persona creator. So, our proposed method is most likely automated by adapting the persona template, REAS and Bayesian network analysis.

We also validated the proposed method and evaluated the persona created by it. The persona created by the results of Bayesian network analysis was expressed by not only the value of research data but also the causal relationship between the data. Although the future subject remained in the expression of the persona’s emotion, it is considered that our proposed method can create the persona substantially catching the target user.

Table 5 Results of evaluation

| Question | Average | Standard Deviation |
|----------|---------|--------------------|
| (1)      | 4.05    | 0.51               |
| (2)      | 2.75    | 0.64               |

*5-point Likert scale

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