

Applying a UCD Approach to Redesign Functionality on ATM: A Case Study in the Context of University and Business Collaboration

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Abstract. Automatic Teller Machines (ATMs) are still one of the most used customer service channels for bank customers. In that sense, the last years, there has been a tendency to increase the range of operations available and implement them on ATM apps. However, it is observed that several of these new features are not used by customers. It is reported that customers do not use them because they do not know them or because they are difficult to use. Therefore, the challenge has been raised of taking an existing functionality of the ATM app and redesigning the user interfaces and the screen flow by applying principles of Usability and User Experience, as well as applying concepts related to HCI, under an UCD approach. Likewise, security aspects have also been taken into consideration, which implies interacting with an ATM. This case study was carried out in the context of a HCI course of the Master in Computer Science of the PUCP University in collaboration with the ATM team of BBVA Peru. There were three meetings between the PUCP student teams and the Bank specialists. In the first meeting, the problem related to ATM functionality was enunciated, in the second meeting the elaborated prototypes were shown, in the last meeting the final prototype was presented with the adjustments obtained after the user evaluation applied. The feedback received was very positive both by the students of the HCI course and by the Bank specialists regarding the improvement of the User Experience in general.

Keywords: Human-Computer Interaction · User-Centered Design · User Interfaces · Usability · Automatic Teller Machine · Case Study

1 Introduction

Pontifical Catholic University of Peru (PUCP) offers, in its Postgraduate Program of Computer Science, the HCI Course for several years [1]. On the approach of learning by practice or learning by doing, the concepts given in class were applied in a real Case Study. To strengthen class knowledge and applying them

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in a real environment, the case were carried out in collaboration with a local financial entity: the BBVA Peru. This collaboration has been going on for some years with good results, both for the bank and for the objectives of the HCI course mentioned [2] [3] [4]. On this experience, it was possible to know the requirement details on the interfaces of the features offered by the ATM, the restrictions regarding the design and the technical aspect were also determined.

As report Santoso et al. [5], today in competitive markets it is very important to have a good level of User Experience (UX) as a requirement for software success. On the other hand, as mentioned Curran et al. [6], we have that the inconvenience of users when using ATMs is very related to the interfaces they present, it is common to see that ATM interfaces are not intuitive and/or efficient as they could be. As it has been seen, it is necessary for companies to be attractive to users and thus guarantee the success of their applications so that they can adopt processes and provide methodologies and tools that guarantee the Usability of their interfaces. And this is not a problem that occurs in a single financial institution but affects most of them. According to the study conducted by Cooharajanonre [7], two important aspects should be considered to improve usability and reduce complexity in ATMs:

- The design of the inherited structure of the menus is very difficult to access.
- Limitation of the numbers of buttons on the screen interfaces.

In this context, the Case Study taken for the postgraduate course allows us to apply the necessary Usability improvements in ATMs, this becomes even more significant by having to add the technical aspect of the devices with which the ATM works, which determine behaviors to consider when presenting ATM interfaces.

Additionally, it should be noted that the prototypes were validated by User Evaluations applied at the BBVA ATM labs. The designs were evaluated by classmates and specialists in the area. During all the stages there was feedback on what was done, which allowed the prototypes to be constantly improving.

Finally, results were presented and delivered to the ATM team of BBVA Peru, with very positive feedback.

This article is divided into the following sections: Background, Case study, where the purpose, methodology, and results are detailed, and a section with conclusions and future works.

2 Background

2.1 Automated Teller Machine (ATM)

According to [8] and [9], ATMs are physical equipment with a client side system that manages security devices and cash handlers, as well as communication with a centralized authorizer. Also, they manage communication with the client, becoming the single point of contact between the client and the bank during the interaction. These devices belong to the self-service domain.

2.2 Human-Computer Interaction (HCI)

HCI involves the design, implementation, and evaluation of interactive systems regarding task and work of the user [10]. HCI also means any communication between a user and a computer, where the interaction could be direct (involves a dialog with feedback) or indirect (may involve batch processing or intelligent sensors controlling the environment).

2.3 Usability

Regarding to [11] Usability in HCI is about the ease of learning, speed of task performance, low error rate, and user satisfaction. According to the established by ISO 9241 for measuring the characteristics of usability, there are three analyses we have to do:

- Analysis of the characteristics required of the product in a specific context of use.
- Analysis of the process of interaction between user and product.
- Analysis of the efficiency, effectiveness, and satisfaction resulting from the use of this product.

2.4 User Profile

A term widely and popularly used to represent real users, this method groups users according to their characteristics. A user profile of the target group represents collective information about several characteristics depending on the necessity of the study [12]. Several aspects to consider about User Profile are Age difference, Gender difference, Cultural difference, and User expertise.

2.5 Heuristic Evaluation

Introduced in 1990, this method involves having a small group of usability experts to evaluate a user interface using a set of guidelines and noting the severity of each usability problem and where it exists [13].

2.6 User-Centered Design (UCD)

User-Centered Design is an approach that seeks interactive systems to become more usable, focusing on the interaction [14]. The standard ISO 13047 proposed a UCD framework for interactive interfaces that has the following steps: Context, Requirements, Design, and Evaluation. In that sense, we used a set of steps aligned to UCD for the development of this experience.

3 Case Study

3.1 Purpose of Study

The purpose of this study was to re-design the interfaces for the current functionalities in the ATMs of BBVA Peru. The Bank provided all the related information about the functionalities and their restrictions, as well as the device's behavior. Device's behavior is an important issue to consider due they have an operation sequence and this influences how long and what information can show to users

There were five functionalities that the Bank indicated we could choose; this paper is about one of them: Credit Card Payment. The main considerations were the following:

- The payment can be done in ATMs by depositing bills and charging an account. We redesign payment by depositing bills.
- The payment can be done in two ways, first, users using a card of BBVA Bank (this way we will call Operation by Card), second, card-less users that just know the number of the credit card to pay.
- Users can pay their credit card or one of another customer.
- Exists a palette of colors and icons to consider.

About the reasons to consider this functionality to re-design, Bank specialists mentioned the next problems: low number of transactions made in ATMs, many steps in the process flow, and insufficient alerts to customers about technical errors and jams.

3.2 Methodology

The User-Centered Design process was used. According to the indications given in class and the theory studied during the course, we explain briefly each step:

Requirements The specialist explained the needs requirements and restrictions to consider for the design of interfaces. This step corresponds to the Requirement phase of the adopted UCD methodology.

Metaphors We made a review of metaphors that ATMs already had before of beginning to design the new metaphors. Each one was evaluated following the criteria: Structuring, Applicability, Representation, Adaptability to ATM domain, and Extensibility. This step belongs to the Design phase of the UCD methodology.

Analysis of Requirements Groups used techniques like ethnographic studies and UX Stories, then they look for the degree of acceptance that users have with the requirement developed and implemented. This step corresponds to the Requirement phase of the UCD methodology.

Prototypes According to the Prototype Model [15], we should build a prototype before developing the actual product. This is an iterative approach for development. This step corresponds to the Design phase of the UCD methodology.

Heuristic Evaluation Classified as ‘evaluation through expert analysis’ and distinguished from the category ‘evaluation through user participation’ [16], so we used the ten heuristics proposed by Nielsen, results were registered. This step corresponds to the Evaluation phase of the UCD methodology.

User Evaluation The usability test was prepared and applied to users. Tests were run in BBVA ATM labs, this allowed users can feel in a real environment. This step corresponds to the Evaluation phase of the adopted UCD methodology.

Revised Prototypes By the end, prototypes were revised by the BBVA team, they analyzed and suggested improvements to prototypes elaborated. This step corresponds to the Evaluation phase of the adopted UCD methodology

3.3 Results

As mentioned, the results were new interfaces designed, which have a higher degree of usability according to Usability Evaluations. This redesign was a product of the steps of the methodology used.

The case study was challenging; the restrictions to considered in ATM devices are essential to have a better perspective of the impact on the interaction of the computer and the user. In the following subsections, we describe the main discoveries and result in each phase conducted.

Requirements BBVA Peru specialists met twice with the course groups. At the first meeting, they described the requirements to implement in the ATM graphic interfaces. At the second opportunity, the students acquitted doubts and shared initial proposals. In addition, any questions or queries were solved by email.

Metaphors After specifying the requirements, we performed an analysis of the metaphors already implemented in the ATMs. Some of them were very close to the abstract representation of the action or element. In others, they considered defining new metaphors. The analysis criteria used were the following:

-Structuring The students designed ten metaphors to represent actions that the final user must execute. Then, groups refined their proposals throughout the project according to feedback obtained from the ATM specialists. As could be seen throughout the flow, the options that allow the client to continue were on the lower right side.

-Applicability The elaborated metaphors were intuitive and familiar to the user. They have sought to be displayed to the user at the right time and guide the user to complete their operation successfully.

-Representation In the beginning, we decided to have all the metaphors with text and images. We took into consideration the fact that an ATM has an interface that cannot be overloaded since this influences the time a user takes in front of one. In the end, we decided to maintain text and image only in those in which the action could not be represented only with images.

-Adaptability to domain Very representative elements of the transaction and ATM were considered. Representing these elements of the ATM domain allows the user to associate the metaphor provided to the option that executes.

-Extensibility The proposed metaphors would not be affected if, in the future, someone decided to implement new functionalities or characteristics to the current one. Each metaphor fulfills its objective representing what it is.

Analysis of Requirements It chose an ethnographic study, and we applied the following two techniques.

-User Profile We defined four classes of users. Each one according to their characteristics, such as objectives, behaviors, gender, occupation, etcetera.

-UX Story The students represented the experience of a user when making a credit card payment at the ATM.

We obtained the following results from the ethnographic study:

- The most common operation performed by users is the withdrawal of cash.
- About 80% of the users have a credit card, only 40% of them have paid their credit card from an ATM, most of them prefer to use a digital channel, mobile banking, or an app.
- Of the users who pay their card by ATM, 16% have needed help to carry out the operation.
- The most suggested improvement is to establish a simpler flow, choosing to reduce the steps or windows shown.

Prototypes After the analysis of requirements, we prepared the initial prototypes. The objective was that the users evaluate the prototypes during the heuristic evaluation stage.

Heuristic Evaluation The evaluation used ten principles proposed by Nielsen [17]. The evaluation was carried out among the other groups of the course. The results obtained are:

- The principle of error prevention represented the main problem (45%). For instance, when a user wants to pay the credit card debt of another customer, after entering the card number, it does not show the beneficiary name, an error in the typing could cause we paid the card of another person.

- After sorting the problems by severity, criticality, and frequency, the first one was “Failure in personal information security” (Nielsen principle “Consistency and standards”). The card number of the beneficiary appears masked in the initial interfaces, but in the last interface, it was shown completely.
- The least amount of problems encountered corresponded to the principle of “Relationship between the system and the real world” this due to the metaphor used to indicate the entry of more bills since it did not accurately represent the function for which it was designed. This metaphor was improved later.

User Evaluation After obtaining the results, making analyses, and improvements to the interfaces that were carried out in the previous stage, the user evaluated the prototypes. The age average of users was 25 years old, the evaluation was running in the BBVA Peru ATM labs. This evaluation consisted of three tasks:

- Task 1 is about making a payment of the client’s card with cash, sending the change to his credit card. As successes, it was possible to identify that the interfaces are intuitive, there was no delay in the execution of them, and as a mistake, a user could not complete a final step of the task that consisted of sending the change to his card, another button on-screen captured his attention and caused it not to culminate.
- Task 2 is about making a card payment from the client by sending the payment change to a cell number. This task was executed successfully by all users.
- Task 3 implied to make a credit card payment from another bank customer (payment to third parties). The main functionality executed successfully, however, the users had difficulty to edit the e-mail for sending the voucher of the operation, this was an additional feature that we gave to the functionality, so we expected to cause some impact on the users.

Each evaluation carried out had a confidentiality agreement and a list of procedures to be performed by the users. For each one, there was always a guide to resolve the doubts presented throughout the evaluation. Before and after the evaluation, each user performed a questionnaire test.

All users recognized that interfaces are simple and intuitive. Also, the information shown in the interfaces was very useful to carry out your task. We can also mention comments indicated by some of the users:

User 1: “I could execute the operation, it took me a few seconds understand some of the metaphors but that it is because I do not usually use the ATM”

User 2: “I had not noticed the limits of bills that can be entered at the ATM, in general, I do not usually see the messages because they seem like a lot of text, instead of with the larger message I could read the advice.”

Revised Prototypes After having carried out all the evaluations and improved the prototypes with the feedbacks obtained, we presented prototypes to the

specialists of the ATM domain of BBVA Peru. As expected, the specialists made punctual observations of technical nature about the interfaces. In general, we obtained the acceptance of the prototypes. Some of the final prototypes can see in the Fig. 1.

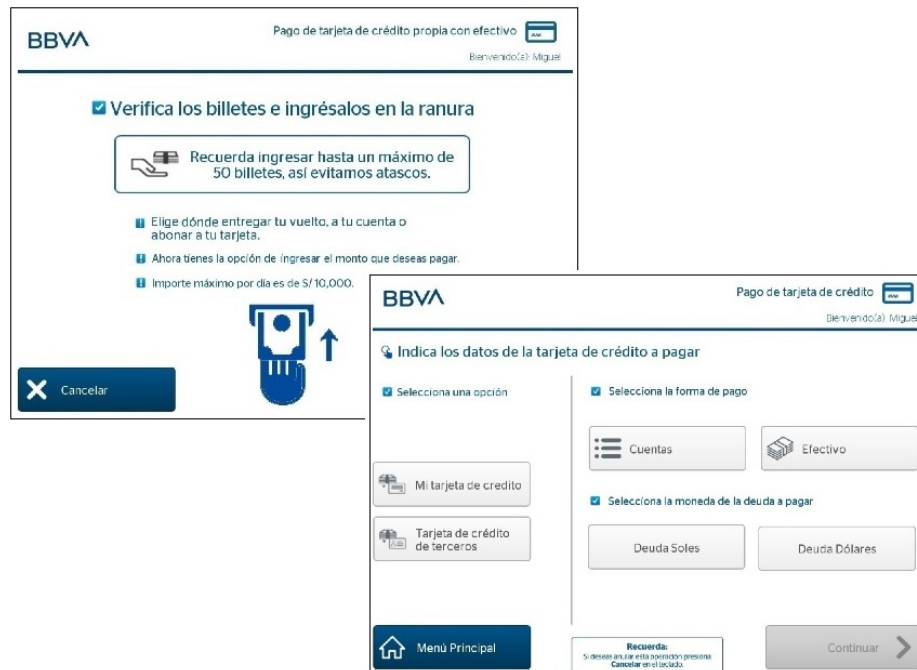


Fig. 1. Some of the final prototypes

4 Conclusions and Future Works

At the end of this experience, we can conclude the following:

- As a result of the execution of the process, we conclude that the designed interfaces met the objective of being intuitive and simple for the user.
- The prototypes delivered were refined thanks to the correct analysis of requirements that allowed us to focus on ensuring the usability of the interfaces.
- Most of the tasks assigned to the users achieved fulfilled with successful results.
- The process used in classes for the execution of the case study ensures that it accomplished the objectives of the course and the project.

- As a result of the complete experience, as a work team, we consider that the application of techniques, processes, and methods in real scenarios and in real-world companies constitutes an important source of learning and feedback for our own professional development.
- Also, as a result of this experience, we consider that user-centered processes and approaches are more effective, more powerful, and generate more value for both companies and end-users. In that sense, we recommend using these approaches in any software development project, and especially those that involve user interfaces.
- As future work, we expect the prototypes to be taken into account and implemented in the financial institution, given the promising results of the user evaluation carried out and presented.

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