



Developing QR Authentication and Fingerprint Record in an ATM Interface Using User-Centered Design Techniques

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Abstract. ATMs are widely used around the world, which leads to the development of new functionalities that need to consider usability. For this reason, the following article presents the development of graphical interfaces for ATM of BBVA Continental Bank, which follows a user-centered process design. In the first place, we gathered information about our target user. Then, we developed a prototype based on the previous information and the needs of the bank, which also took into account expert's feedback. Finally, real users in the bank itself validated the prototypes.

Keywords: Human-Computer Interaction · User-Centered Design · Usability · Automated-Teller Machine

1 Introduction

An Automated-Teller Machine (ATM) is a computer-based interactive machine that offers several banking services. It allows consumers to make deposits, obtain cash from bank accounts, pay bills, transfer money between accounts, print statements and do many other routine transactions as they would at a normal bank teller window [1].

According to ATMIA [2], the automated teller machine is one of the devices that improved the financial services among people. Currently, these machines are acquiring new features different to the classical money delivery.

In this context, the BBVA Continental, one of the leading financial entities in Peru, started an improvement process of its ATM applications in order to offer a better experience to its final user [3].

To contribute with this goal, the BBVA Continental requested master's degree students the design of a usable interface that would permit the following

functionality: To get a new credit card being a new user or get a duplicate of the credit card being a known user using secure methods such as QR authentication or fingerprint recorder.

The development of the proposal included the following techniques: personas, empathy maps, storyboards, prototypes, individual interviews, and user testing. The prototypes were analyzed by experts in the field in order to get feedback and improve the prototypes in an initial stage.

The validation took place at the BBVA Continental with real users, which allowed taking feedback and improving the prototypes.

2 Background

2.1 Usability

According to Nielsen [4], usability is a quality attribute that assesses how easy user interfaces are to use. Nielsen proposes five quality components to define usability:

- Learnability, which measures the facility for users to accomplish basic tasks the first time they encounter the design.
- Efficiency, which measures how quickly users perform tasks once they have learned the design.
- Memorability, which measures how easily users can re-establish proficiency after a period of not using the interface.
- Errors: which measures how many errors the user makes and how easily it is to recover from those errors.
- Satisfaction: which measures how pleasant is the design itself.

2.2 User Experience

User Experience (UX) is considered a much broader aspect than usability, and is defined by the ISO 9241-210 standard as a “person’s perceptions and responses resulting from the use and/or anticipated use of a product, system or service” [5]. This aspect is not only related to the ease of use of a graphical user interface, but also to the satisfaction degree, emotions, and perceptions that a user can feel during and after the interaction with the system.

2.3 User-Centered Design

The User-Centered Design is a multidisciplinary approach that invites end users to participate in the design of a product. Initially, it focuses on deepening the understanding of users and requirements. Then, an iterative process of design and evaluation is carried out considering the observations that the users could point out [6].

The importance of this collaboration lies in obtaining high value information which will be used to improve and focus the developers work. A UCD design process applied will carry some benefits for the company for example a better ROI (Return on investment) [7].

Personas. Personas allow creating a fictional, yet realistic, description of a typical or targeting user of product [8,9]. Effective personas:

- Represent the important needs of a group.
- Express the user expectation about the system and how likely they are to use the system.
- Describe people with goals, values, general background.

Empathy Map. In user-centered design, empathy maps are best used from the very beginning of the design process. According to Gibbons [10], an empathy map is a “collaborative visualization used to articulate what we know about a particular type of user. It externalizes knowledge about users in order to (1) create a shared understanding of user needs, and (2) aid in decision making”.

Prototyping. According to Affairs [11], a prototype is a draft version of a product that allows you to explore your ideas and show the intention behind a feature or the overall design concept to users before investing time and money into development. A prototype can be anything from paper drawings to something that allows click-through of a few pieces of content to a fully functioning site.

User Testing. According to Paz et al. [12], user testing is a method in which a representative amount of end users interacts with the software following a list of predefined tasks. Exhaustive observations of these human-system interactions allow the identification of usability issues related to the system.

3 BBVA ATM Interfaces Design

3.1 Demand

With our approach, we want to design usable interfaces that can be used for BBVA ATMs, keeping in mind that we will design the interfaces for a new requirement: to get a credit card. From a meeting with BBVA representatives, all related information about the requirement was obtained, of said information the following is highlighted:

- The requirement has two kind of users: BBVA clients and non-clients, so specific interfaces must be developed for both.
- Clients could get a duplicate of a lost credit card.
- Non-clients could receive a new credit card.
- Security controls must be employed to assure user identity.
- Find and try to distinct alternative mechanisms to reduce possible implementation cost of interfaces.
- Optimize time spent on getting a credit card.

Also, as a result of the meeting, the acceptance criteria for interfaces was established:

- Clients find appropriate the way the new requirement is presented.
- Clients find appropriate the security controls used in their corresponding interfaces.
- Clients show a positive reaction from interaction with the new requirement.

3.2 Design Process

Interfaces design was developed following a user-centered process. According to disciplines and methods reviewed in the previous section, the next process was followed:

Metaphors Design. In this step, metaphors were designed to help user to find the new requirement through ATM interface and also as guide in the process. Figures 1 and 2 are part of the group of metaphors developed.



Fig. 1. A metaphor to represent the requirement of get a credit card



Fig. 2. Metaphors to distinct process between get a new credit card or duplicated one

Identify User Profiles. The activity consisted of an interview using a ten question questionnaire where a user was asked about common and relevant information like:

- Name, age and gender.
- Expertise level using ATMs.
- Reasons to use ATMs.

From all data collected, target user profile was developed. Persona method is applied in this step obtaining two profiles: a experienced person with technology and a person less experienced with technology. However, both profiles show some concerns about the security and speed of the interaction with ATM. Figure 3 shows details about the experienced person with technology specifying their goals and concerns.

Rubén Cevallos



"Tengo afinidad con la tecnología pero soy consciente de sus riesgos"

Edad 20 - 40

Ocupación Estudiante Universitario / Profesional

Motivaciones

- Información
- Seguridad
- Rapidez
- Novedades tecnológicas

Objetivos

- Culminar sus actividades en el menor tiempo posible
- Mantenerse informado durante sus actividades
- Usar tecnología usable en su rutina semanal

Frustraciones

- Se siente inseguro al usar cajeros automáticos y al realizar transacciones por internet que involucren dinero
- Invertir más tiempo de lo necesario en tareas fuera de la rutina.

Biografía

Invierte el tiempo en sus labores como estudiante o profesional lo cual le deja poco tiempo para realizar actividades fuera de su rutina cotidiana.

Esta pendiente de avances en tecnología y de su empleo en su entorno. Además prefiere tomar el camino más seguro cuando toma decisiones debido a la inseguridad presente en la sociedad.

Banca Móvil





Fig. 3. Persona: Experienced person with technology

Deepen Vision of Target User. In this step, the goal was to contrast the knowledge of the development team about the target users before and after the interview mentioned above. The result of this activity allowed to design interfaces oriented to both target users, organized and presented according to all information collected through the process.

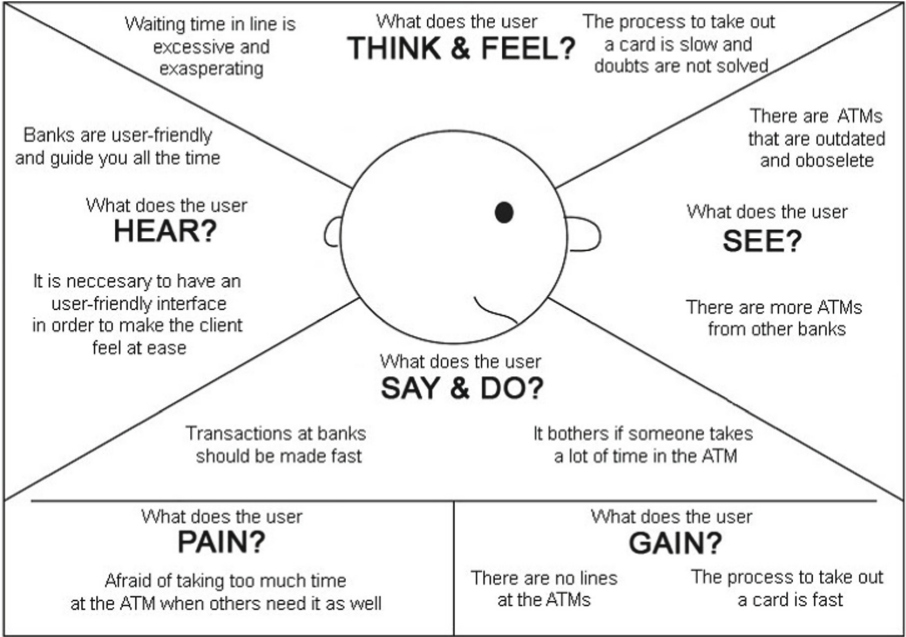


Fig. 4. Empathy map about person experienced with technology

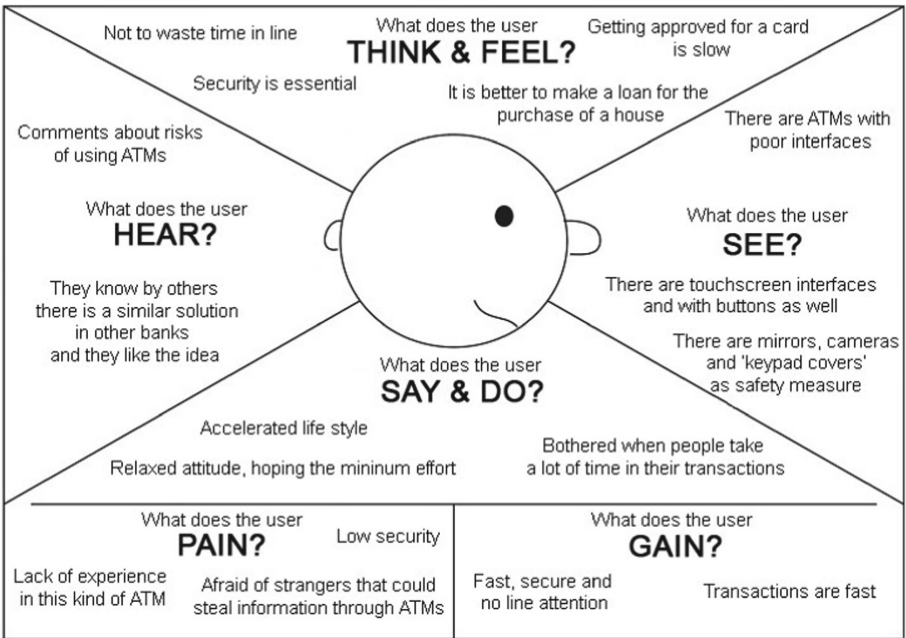


Fig. 5. Empathy map about team knowledge about target users

Brainstorming. The development team looked for a way to represent both workflows (for each target user) by brainstorming (Figs. 4 and 5).

Prototyping. In this step, all ideas were placed into a paper prototype and then improved as digital prototype. The improvement of paper prototype was done with feedback receive from BBVA representatives and usability experts (Fig. 6).



Fig. 6. Paper prototype: Details of new credit line (Non-client workflow)

Usability Test. In this step, a user testing was performed with five users which were representative of our two target profiles. The test environment was provided by BBVA Continental bank, however, due to some features of the designed solution could not be emulated as real as the team wished, users interaction with ATM was affected negatively. More detail about this evaluation on next section.

Improve Prototypes with Users Feedback. Last step, after analyze the feedback from users, some improvements were done to the solution proposed. These improvements, basically, consisted of organize better the presentation of a specific task (block a existing credit card before proceed with workflow) or highlight a specific need to proceed (activate a checkbox).

4 Usability Test

In order to test the usability of the prototypes designed, a usability test was performed. As mentioned above, the objective of this activity is find any problem a user could deal while is interacting with the ATM interface (Figs. 7, 8 and 9).



Fig. 7. Paper prototype: Preview of duplicate credit card. (Client workflow)

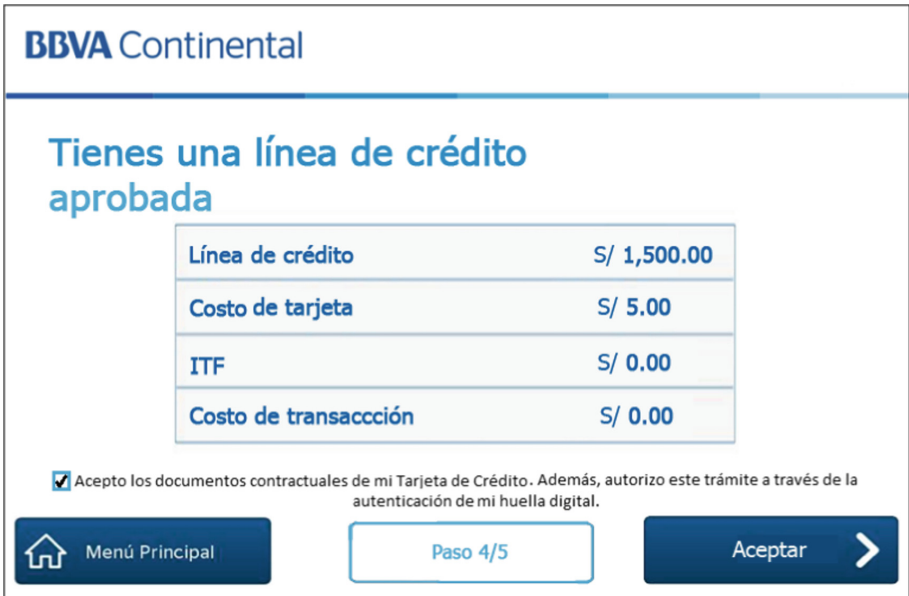


Fig. 8. Digital prototype: Details of new credit line (Non-client workflow)



Fig. 9. Digital prototype: Instructions to continue the process of duplicate a credit card (Client workflow)

4.1 Planning

Some materials were made to use during the execution of the test, a pre-test questionnaire, a task list, scenarios, a post questionnaire and a evaluation tool to track user interaction with developed ATM interfaces. Also, a document to assure the confidentiality of any information given by users was made. All of these materials were prepared to be used by five users which match with the target profiles identified on design process.

4.2 Execution

Test were made on November 29th and 30th, 2018 in San Isidro, Lima. After receiving the users and explaining the test workflow, each one was given all prepared materials necessary to complete the test. In the first place, each user had to sign a Confidentiality Agreement and a pre-test questionnaire. Then, with a list of task, one by one, users where performing each task while a monitor was in charge to take notes about any problem that could happen. Regrettably, due to inherent features of the proposed solution, it was not possible for the team to reach a hundred percent of similarity between the environment test and a real situation. Some of these lacking features to test were:

- Blocking a credit card with BBVA application mobile.
- Automatic response from ATM when a fingerprint is scanned correctly.
- Automatic response from ATM when a evaluation task is completed.

4.3 Results Analysis

From the obtained results, we can confirm that:

- 70% of the users were able to perform the first task with no issues, which consisted in obtaining a credit card duplicated. These users (70%) had a positive attitude towards the QR functionality because they considered it innovative or something they have not seen before in an ATM. The remaining 30% of the users felt that the missing experience, due to the lack of QR software in the ATM, did not satisfied them and that changes can be made.
- 75% percent of the users in the second task considered it was easier than the first one due to the fact that they have already interacted with the application, and that although it is not the same task, task 2 is about getting a new credit card, they felt that the last steps, about confirming the process was similar. The missing 25% percent expressed that it could not be that easier, that we had to be more explicit in the details, because it is an important transaction.

From the feedback of the users, the defects identified are:

- The message about blocking your lost credit card before proceeding to get a duplicate was unclear due to the fact that it did not have a clear button to continue. Users understood this message as a step and not as an advice
- The acceptance text to proceed with the new credit card was small, so important information as this needs to be highlighted

The defects identified were corrected and sent to BBVA Continental in order for them to take into consideration.

5 Conclusions and Future Work

From results obtained from the usability test, we can assure that most of users completed all tasks without any major difficulty, but also due to inconveniences to simulate both process (specially the one about getting a new credit card), users expressions reflected confusion at moments when the workflow could not continue naturally. We can conclude that the deep analysis of our users led us to not make many mistakes.

For future work, we want to improve the test environment used in this test or prepare a one by ourself to gain a better feedback from users, because with the current limitations our results have been affected in a way that at first impression was negatively reflected but could even be positively. Similarly, take into account the feedback provided by the users after the experience.

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