



# Design of Graphical User Interfaces to Implement New Features in an ATM System of a Financial Bank

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**Abstract.** Actually, many bank customers would like to be able to perform various banking operations from an ATM in such a way that the entire process of long queues is avoided and the waiting time in the transaction process is reduced, which must guarantee the security of the customer's data. That is why, as part of the human-computer interaction course of the PUCP of the master in informatics, it was decided with the support of the BBVA Continental to develop the design project of new operations for its ATMs. For the development of this project, three meetings were considered. In a first meeting, information was gathered with the bank's workers, to be clear about how the operations that are to be designed are being carried out. For our second meeting, the evaluation of the prototypes was carried out in the bank's facilities, for which usability tests were developed. In the last meeting, the improved prototypes were presented according to the breaks recorded in the usability tests. Ultimately, in order to carry out this project, a framework was developed which guaranteed constant interaction with our users and being able to meet all their needs.

**Keywords:** Human-computer interaction · User-centered design  
Graphical user interfaces · Usability · Automatic teller machine

## 1 Introduction

According to the study carried out by Curran [1], the inconveniences of using an ATM are closely related to the design of the interface, as it is apparently mentioned that many ATM navigation menus are still not as intuitive or as efficient as they could be. In this context, BBVA Continental, which is one of the leading financial entities in Peru, has been showing interest since a few years ago in the development of interfaces with user experience in its transactions.

According to the work carried out by Moquillaza [2], BBVA changed its ATM application a few years ago. In this previous study, the authors determined that the interfaces of their software systems needed improvements in usability. However, there was not much information or methods in the industry to develop usable interfaces for ATMs.

According to the study conducted by Peres [3], it is argued that banks invest more in projects focused on the user and for this purpose considers two necessary methods:

- Usability evaluation.
- Cognitive Inspection.

According to the study carried out by Cooharajanonre [4], two very important aspects are considered to improve the usability of ATMs and reduce their complexity:

- The design of the hierarchical structure of the menu is very difficult to Access.
- Limitation of the number of buttons on the interface screen.

Regarding the usability heuristics that are applied in ATM systems, those mentioned in the Rosenbaum [5] study are considered, which are quite clear and are applied in the same way in transactions such as user control and freedom, prevention of errors and visibility of the state of the system.

According to Van der Geest [6], two aspects must be considered when designing a better user experience:

- Address the user experience as a multi-dimensional construction that includes affective responses to the instrumental qualities of the system.
- Also treat the emotional responses, feelings, and emotions before, during and after the experience of using it.

In this context, BBVA Continental contacted the Pontifical Catholic University of Peru to present its case and requested the improvement of its interfaces. BBVA Continental requested the design of its new banking operations as part of the process of improving the usability of its ATM system. The design should allow the following functions: online check deposit, payment of services and collections for non-customers, the sale of tickets and frequent transactions such as transfer to third parties, payment of services and collections for customers, fast deposit and fast withdrawal.

Later the project was considered as part of the human-computer interaction course of the computer science master's degree. The teacher proposed this project to be developed throughout the course. The final product for the students was to develop a prototype validated by the users.

In order to develop these proposals, the following techniques were considered: metaphors, usability engineering, user profiles, UX story, semiotic engineering, and others.

Finally, for the validation of the prototype, we use the user's tests. Then the design was validated with real users who were classmates and workers of BBVA Continental. This validation allowed for feedback and new information, which was used to improve the prototype.

## 2 Background

### 2.1 Human-Computer Interaction

According to the study conducted by Garg [7], HCI is the field of computer science that focuses on the interfaces between humans and computers. It refers to the way in which humans interact with computers and how they provide the user with a pleasant experience.

## 2.2 Metaphors

According to the study carried out by Abdulhassan [8], metaphors are a conventional approach to user interface design, and he also mentions two reasons to use them:

- You can take advantage of people's knowledge of the world around them by using metaphors to convey concepts and features of the application.
- The recognizable metaphors provide a direct and intuitive interface for the user's tasks.

It also mentions the benefits of adopting metaphors:

- Makes learning new systems easier.
- It helps users to understand the underlying conceptual model.
- It can be very clever and allow computers and their applications to become more accessible to a greater diversity of users.

## 2.3 Usability Engineering

According to the study carried out by Chen [9], usability engineering is an advanced methodology of systems development based on psychology. It uses many methods of research in psychology, labor efficiency of human beings, industrial design, man-machine interface, sociology, computer science, statistics, etc. Values human factors in the application of technology also improves the development of the user-centered design.

## 2.4 User Profiles

According to Granollers [10], we can understand the user profile of an interactive system as a detailed description of the attributes of the users (work, education, usual tasks, age, etc.). These characteristics are usually reflected in ranges of values, and in this way, real users will be within those fields.

## 2.5 UX Story

According to Gibbons [11], a UX Story is an account of events from the user's perspective; the events in the story show the evolution of an experience.

## 2.6 Heuristic Evaluation

According to the study conducted by Nielsen [12], the heuristic evaluation is an inspection method, in which 3 or 5 usability experts judge whether each element of a graphical user interface follows the established principles, called heuristics.

## 2.7 Semiotics Engineering

According to the study carried out by Souza [13], semiotic engineering is defined as a branch of computer engineering focused on the research of communication between designers and users. In semiotic engineering, HCI is a meta-communication process.

## 2.8 Usability Test

According to the study conducted by Paz [14], the usability test is a usability evaluation method in which a representative number of end users are asked to interact voluntarily with the system. During this test, users must perform a set of predefined tasks using the software product that was tested. While users use the software, usability specialists can identify usability problems through user observation.

# 3 Case Study: Design of New Functions for the ATM Interfaces of the BBVA Continental Bank

## 3.1 Purpose of Study

The objective of this work was to design the new functionalities for the ATM interfaces of Banco BBVA Continental. This new interface must meet the following requirements:

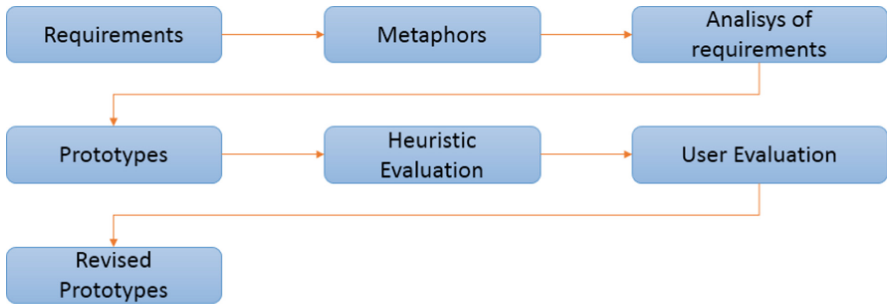
- **Checks:** Deposits online, only own checks, one check at a time.
- **Payment of services and collections for non-customers.**
- **Ticket Sales:** Sale of Tickets, with a debit and cash.
- **Frequent Operations:** Transfers to Third Parties, Payment of services and collections, fast deposit and fast withdrawal.

The bank through two meetings held in the classroom provided all the information related to how these operations are performed at the window, and what are their requirements to consider in the design of these functionalities in the ATM interface. In addition, the bank established two main objectives.

- Provide the design of new functionalities that adapt to the needs of the user.
- Apply quality usability tests to obtain good feedback from the user and develop quality prototypes.

## 3.2 Methodology

The design of the functionality will be based on the user-centered design, according to the topics and techniques developed in the course, in the order shown in the following diagram (Fig. 1):



**Fig. 1.** Steps to make the proposal based on the User-Centered Design Methodology

### 3.2.1 Requirements

In this first point, we took note of the needs of the users of Bank BBVA Continental where they provided their requirements as a discussion in two meetings held in class.

### 3.2.2 Metaphors

For the development of the metaphors the following evaluation criteria have been taken into account: Structuring, Applicability, Representation, Adaptability to the domain and Extensibility.

### 3.2.3 Analysis of Requirements

At this point, we try to find the degree of acceptance that users have with the requirements raised for which was made first of an ethnographic study and then made use of the technical people and user experience stories.

### 3.2.4 Prototypes

At this point, the prototypes and navigability were designed according to previously identified requirements.

### 3.2.5 Heuristic Evaluation

For the heuristic evaluation, the methodology was used, which consists of applying the ten basic principles presented by Nielsen [12], in order to find some observations by the evaluating users, an analysis of the results can then be made and determine what their modifications.

### 3.2.6 User Evaluation

At this point, usability tests were prepared for the users. The result of this point allowed to identify improvements to the proposals and feedback from the users on the functionalities and other related aspects, normally ignored in the design time.

### 3.2.7 Revised Prototypes

In this last point, we considered both the feedback received by the students of the course and the workers of the BBVA Continental, to analyze it and proceed with several improvements in the prototypes delivered as a first artifact.

## 4 Results

As mentioned, the methodology described follows the techniques learned and developed throughout the course.

The challenge of this design is to develop and add new features to the automatic teller machines of Bank BBVA Continental. In this sense, an analysis is required of both the requirements of the interested users as well as the needs of the people when interacting with these new functions.

### 4.1 Requirements

In order to meet the requirements, two meetings took place in class with the BBVA Continental Bank group to consider the details of how the operations currently being implemented in their ATMs are being carried out.

### 4.2 Metaphors

As previously mentioned in the methodological part, criteria learned and developed in the course were considered to make user interaction with the interface as user-friendly as possible. These criteria are the following:

- **Structuring:** We are considering a set of metaphors of eight elements; the most used functions are on the right.
- **Applicability:** Each of our metaphors is applied when the user requires it, he knows when to apply it because our metaphor is intuitive.
- **Representation:** Our metaphors are associated with text and image, and the user interprets metaphors in a unique way.
- **Adaptability to the domain:** For the user of our domain it will be very easy to associate image and text. Our set of metaphors has been designed from the physical domain.
- **Extensibility:** It could be the case that by including new functionalities in our metaphors, the current structuring of these changed.

The design of the metaphors are shown in the following scheme (Fig. 2):



Fig. 2. Design of Metaphors

### 4.3 Analysis of Requirements

At this point it was considered to carry out an ethnographic study first, then two techniques were used; first, the user profile technique was used to then use the UX Story technique. The following results were obtained from the ethnographic study:

- Users who make check deposits see it convenient to do it by ATM since they would save time instead of doing it through the window.
- The majority of the users who make purchases of tickets, see viable the fact of making a purchase from the ATM as long as it is simple and clear.
- Users over 60 years of age are more distrustful of ATM use due to fear of faults, so they prefer to do their operations directly at the windows.
- The majority of users as one of its most used operations has cash withdrawal, so the option of frequent operations Fast withdrawal; It would be one of the options that could be the most used.

Then, using the user profile technique, the following results were obtained:

- Users between 25 and 35 years of age consider making the check deposit by ATM, in this way they avoid the long queues to be served at the teller window. They also consider buying tickets for ATMs, always and when they have all the clear information about them (hours, prices, seats, etc.).
- In users over 60 years of age, there is a certain degree of mistrust in making purchases through ATMs, but a good number of users are interested in buying tickets in ATM to events because it would save time.

Finally, to complete this step, we considered the UX Story for the functionalities, as shown in the diagram (Fig. 3), the user experience in the realization of the services payment operation.

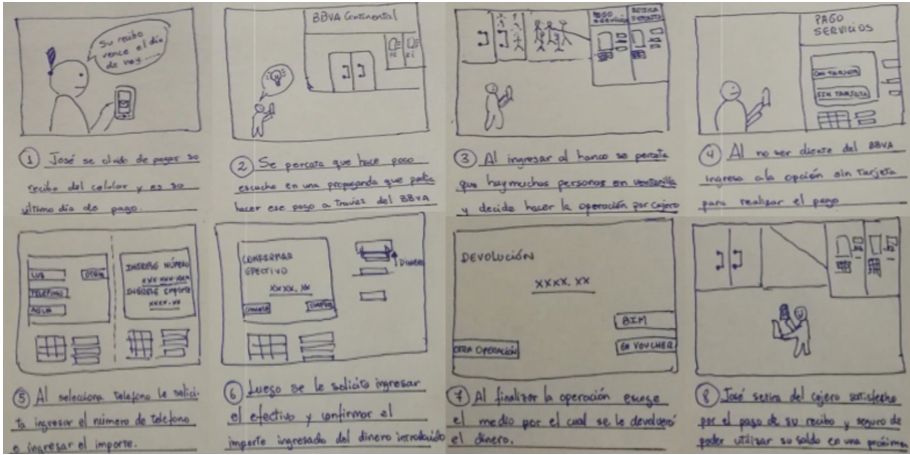


Fig. 3. UX story payment of services

#### 4.4 Heuristic Evaluation

In this stage, colleagues from another group carried out the evaluation of our prototypes in their first version, taking into account the ten principles presented by Nielsen [12], in order to consider them in the redesign of our prototypes. The results of the evaluation were the following:

- On the principle of prevention of errors, the evaluated product presents in its operations several inconveniences that do not allow to go back to the previous step. This possibility has been confused with the action of canceling and definitively leaving the operation.
- About the principle of coincidence between the system and the real world, the product has deficiencies in the definition of the graphics component that allows the selection of options (for example, the distribution of seats on a bus).
- The aesthetic and minimalist design is the principle with fewer associated problems. The product has correctly divided each of the steps in such a way that the user recognizes exactly what is to be done in each one of them. The interfaces are precise, clear and do not present elements that could confuse the user.

#### 4.5 User Evaluation

After considering the changes proposed in the previous stage, the redesign of our prototypes was made, then we proceeded to evaluate these prototypes reviewed by four classmates who will have the role of real users of the system and evaluate the operation of making a quick deposit as also eliminate a fast deposit. The results of this evaluation were the following:

- In task 1, making a fast deposit, users developed activities with delay because they did not easily find the frequent operations option.



- In task 2, delete a fast deposit, users developed activities with delay because they did not easily find the frequent operations option.
- All users considered that the information required in the test was easy to find.
- All users consider that the information obtained has been useful.
- All users agree that the most pleasant thing about the fast deposit operation was its simplicity.

#### 4.6 Prototypes

As a result of the methodology described, the following interfaces were proposed and sent to BBVA Continental. Some of the proposed screens were the following (Figs. 4, 5 and 6):



Fig. 4. Operations for clients (prototype)



Fig. 5. Frequent operations (prototype)

**Depósito de cheques**

**Datos de cheque**

Nro. de Cta. Cte.	Nombre del titular
0011-0900-066812351	Francesco Ganoza.

**BBVA** 0005563A 001/300  
 0011-0900-066812351 % 1500.00  
 Páguense a la orden de: Francesco Ganoza  
 La suma de: Mil quinientos nuevos soles.  
 Roy Meléndez Meléndez 02 de Junio de 2017  
 Firma

CANCELAR CONTINUAR

Fig. 6. Deposit of checks (prototype)

## 5 Validation

For this section, what was obtained in the user test was discussed. In this test, our evaluated were four participants who are students of the course and workers of the BBVA Continental, whose ages ranged between 27 and 30 years. In addition, the test was executed in the testing environments of the Bank BBVA Continental.

In addition, the test was performed individually, where each user had at his disposal an evaluator who accompanied him in the process. The confidentiality agreement and a list of previous indications were also presented to each participant. Each participant agreed and signed the indicated documents.

Subsequently, each participant was given the pre-test questionnaire, which was filled immediately. Next, each participant was given the list of tasks, and some general queries were resolved, immediately after recording the interaction, and the user was left in front of the cashier, and each evaluator took note in the compliance form the tasks, and the breaks that were observed. Finally, each participant was given the post-test questionnaire to complete it with the information requested, which ended the execution of the test.

## 6 Conclusions and Future Work

At the end of this design, we can conclude that the delivered prototypes allow users to use the system with greater satisfaction.

It was also concluded that it is necessary to follow a process of analysis requirements and interaction design to guarantee a design focused on the real needs of the user.

From the results obtained from the usability test, we can affirm that the majority of the users did the tasks without much difficulty.

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