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Conference Paper · May 2017

DOI: 10.1007/978-3-319-58640-3_49

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Developing an ATM Interface Using User-Centered Design Techniques

Arturo Moquillaza[1(✉)], Edward Molina[2], Edilson Noguera[2], Leidi Enríquez[2], Adrián Muñoz[2], Freddy Paz[1], and César Collazos[2]

[1] Pontificia Universidad Católica del Perú, Lima, Peru
{amoquillaza, fpaz}@pucp.pe
[2] Universidad del Cauca, Popayán, Colombia
{eamolina, eynoguera, leidi, jorgevelasco, ccollazo}@unicauca.edu.co

Abstract. ATM interfaces nowadays present serious issues in usability and accessibility, frustrating users' interaction and leading them to make operational mistakes. For this reason, we present the development of graphical interfaces for ATMs of BBVA Continental Bank, which follows a process of user-centered design. The priority was to identify the real needs of users based on the context, and to understand how they interact with the interfaces. In order to validate our proposal, we established a model and a functional prototype. Later, we evaluated this new design with a usability test. Based on the defects that were found, we applied changes to improve the interfaces. Finally, after an in-depth analysis, we concluded that the designed interfaces were suitable for implementation in the ATMs of BBVA Continental Bank, due to the process followed and the acceptance by users.

Keywords: Human-computer interaction · Semiotic engineering · User-centered design · Usability · Automatic teller machine

1 Introduction

According to the study performed by Granollers et al. [1], Latin-American industry is worried about HCI, UX and usability. In this line, BBVA Continental Bank, which is one of the leading financial entities in Peru, is worried about user experience in all its channels. A few years ago, they changed their ATM application. They noted that the interfaces of their software systems needed improvements in in usability. However, there is not much information or methods in industry to develop usable interfaces for ATMs. There are several guidelines about how to design web interfaces, but little information about how to apply those principles to ATM or self-service interfaces.

According to the study performed by Cooharojananone et al. [2], there are two relevant aspects that should be considered when we design interfaces for ATMs: (1) the software application process sensitive information, and (2) the interface has limitations because of the number of buttons. The first aspect could influence the customer's behavior. The second feature gives the experience a strong limitation, which impact directly on the usability of the system.

A. Marcus and W. Wang (Eds.): DUXU 2017, Part III, LNCS 10290, pp. 690–701, 2017.
DOI: 10.1007/978-3-319-58640-3_49

Regarding the methods and techniques that have emerged to develop usable ATM interfaces, the study performed by Rosenbaum [3] states that the conventional Nielsen's heuristics can be applied, especially (N3) User control and freedom, (N5) Error prevention, and (N1) Visibility of system status.

According to Van der Geest et al. [4], a good ATM service should achieve two goals:

- The feeling that there is a reliable, responsive, empathetic, and knowledgeable service employee available to help us
- The belief that an organization is committed to caring for about us, because our customer experience matters to them

In this context, BBVA Continental Bank contacted "Universidad del Cauca" in order to present its case and requested improvement of its interfaces. BBVA Continental Bank requested the design of a new usable interaction that would prevent user frustration. The design would need to permit the following functions: Payment to companies and Updating of personal data.

Then, the case was taken up by "Universidad del Cauca" in an HCI undergraduate course. The teacher proposed this case for developing along the whole course. The final product for students was to be a prototype validated by users.

For developing those proposals, we used the following techniques: activity theory, user profiles, and semiotic engineering, among others.

For validation of the prototype, we used user testing. Then, the design was validated with real users. This validation permitted getting feedback and new information, which was used to improve the prototype.

Finally, the prototype was delivered to BBVA Continental Bank, which valued positively the whole experience and the product received.

2 Background

2.1 Human-Computer Interaction (HCI)

According to the study performed by Peres et al. [5], HCI can be defined as a discipline with focus in the design, evaluation and implementation of interactive systems for human use, and what happens when a human and a computer system perform tasks together.

2.2 Usability

Usability is defined in ISO 9241 (2002) as "*The effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments.*" According to this definition, and Peres et al. [5], there are three analyses we have to make in order to measure usability:

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

2.3 User Profile

According to the study performed by Moreno [6], user profiles describe users of the computer system and provide details of their relevant characteristics. This way, requisites capture is centered on the most relevant for the user, and let a design with an adequate level of usability. User profiles are fundamental in user-centered design processes.

2.4 Semiotic Engineering

We can apply concepts of Semiotic Engineering in design and building of artifacts. The word Artifact (De Souza, 2005) describes something created by humans, and its meaning or value is intrinsically associated with the creator's intention, and the interpretation of the users about how, when or where it can be used [7].

This concept is centered in communication, but in a new type. Designer interaction is the emitter, and the designer communicates by symbols defined for the understanding of a determinate user, the receiver. Those symbols should be translated by computers, which are the mediator between emitter and receiver, carrying the message [7].

2.5 Activity Theory

According to the study performed by Carvalho et al. [8], Activity Theory is a line of investigation started by some Russian psychologists, among them Vygotsky and Leontiev. This theory studies the human practices and its development processes. The basic elements of analysis are the activities of people, which are volunteer interactions between a human and an element or object.

HCI take an activity as an action that a user wants to perform, and a computer as his tool or object, besides every button and every interface as another class of objects for the user to accomplish his task.

Activity Theory emphasizes the social dimension in which the activity is located in a determinate context. This social vision permits, from different perspectives, emphasis in every moment the elements which take place in the performance of every task [9].

2.6 Usability Test

Several usability methods were proposed in order to evaluate the level of usability of computer systems. According to the study perfomed by Holzinger [10], these methods are divided into two groups: usability inspection methods and usability testing methods. According to Paz et al. [11], the main difference between them is that in inspection methods; usability problems are detected by specialists using inspection techniques, and in testing methods, usability problems are found through the user's observations while they are using or making comments about the interface of a computer system.

3 Case Study: Design of the ATM Interfaces for BBVA Continental

3.1 Purpose of Study

The purpose of this study was to design usable interfaces for ATM of BBVA Continental; however, there were not typical functionalities such as Cash Withdrawal or Balance Inquiry. Then, this new interface should give support to the following requirements: payment to companies and updating of personal data.

The Bank provided all the related information in order to students could develop their proposals according to requirements and complementary information. Three objectives were established by the Bank, for any proposal:

- Proposing an interaction design of ATM interfaces that fulfills users' needs of usability.
- Applying an interaction design process for building good interactions with quality.
- Validating the interaction design by the executing of a usability test.

3.2 Methodology

Interface design was developed following a user-centered process. According to disciplines reviewed in the previous section, and developed in class to students, students adapted in a process made by the following steps:

1. Identify User Profiles

Students identify characteristics of possible representative user of system. The importance of this activity is letting the designer know for who he designs, what the user expects and in what way. Interface design proposed should be oriented to the user, organized and structured according to profiles defined in this step.

2. Analyze Existent ATM Interfaces

Students analyze current ATM interfaces of the Bank and ask questions about business rules and style guides predefined. The importance of this activity is proposing interfaces that respect guides and rules previously established, and discover what of these rules can be broken by new proposals.

3. Brainstorming

Students identify by Brainstorming relevant assets for interfaces, having aspects of usability, accessibility, culture and emotions, under semiotic engineering and activity theory.

4. Prototyping

In this step, students design prototypes according with requisites given and items identified in previous steps.

5. Running a Usability Test

In this step, students prepare a usability test to real users, which should be selected from user profiles defined in previous steps.

As prerequisite for the test, students designed a physical mockup similar to a real ATM in order to validate their proposals and to apply the Test. The principal activities of this step are: Planning, Execution and Analysis.

The result of this step permitted identifying and proposing improvement to proposal and getting feedback of real users about interfaces and other aspects related, normally ignored in design time.

6. Make Improvements Over Prototypes

In this step, students improve their own proposal. This activity is very important because is the materialization of the feedback of real users, obtained by a formal method (Usability Test). Prototypes with improvements can be shown to new users in less formal tests. At the end of this step, prototype is already validated with actual users, then, the proposal is ready for being delivered to the Bank.

3.3 Interface Design

User Profiles. All BBVA Continental customers were identified as users, and were separated into three user profiles. The principal difference was the level of expertise using ATMs.

All the users have the same objectives: Doing a payment to companies and Updating his personal information, both by the ATM.

Semiotic Engineering. The interaction design process should ensure the adequate expression about what we can communicate, so that users interpret them from their context, as if they were communicating directly with the designer.

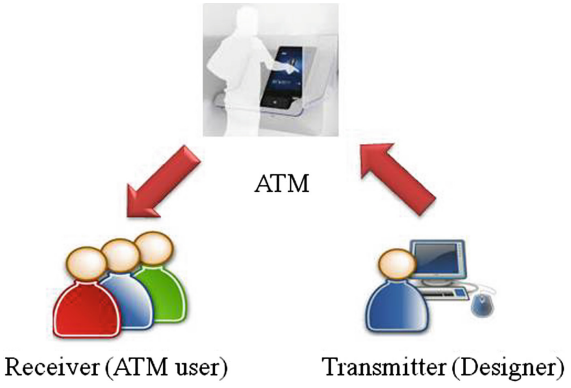

Fig. 1 Semiotic engineering in the interaction designer- ATM-user

Considering this principle, we generated scripts that define the steps that designers of interfaces expect that users understand when they use the interfaces in the ATMs.

The sequence defined in each phase then was translated into interfaces for the ATMs, which are interpreted and displayed by the user, according to the following scheme (Fig. 1):

Activity Theory. By this theory, we identified the tool, the rules and how is organized the division of work.

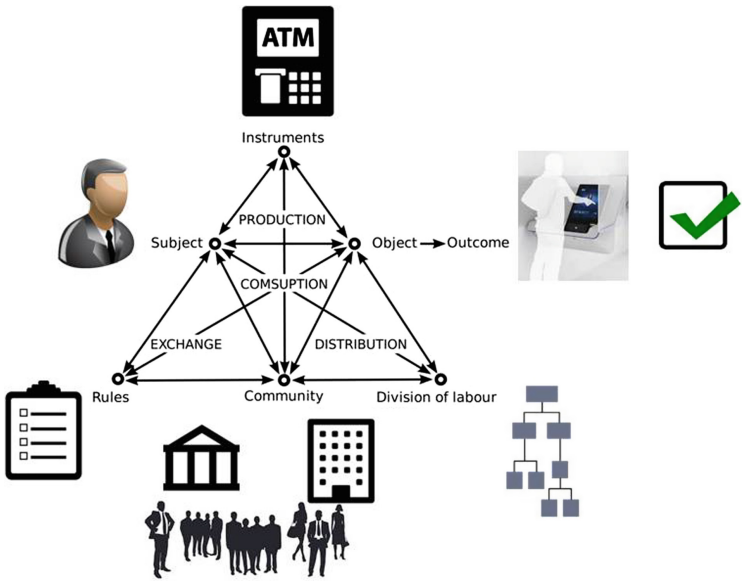

Fig. 2 Application of activity theory

According with Fig. 2 above, we made these interpretations:

- Community: The set of individuals who are clients of BBVA Continental, and can be established in one of the profiles described.
- Division of work: Every individual of community will have a role.
- Rules: Requisites defined by community in order to use the tool. In this case, rules can be: Being a BBVA Continental client, having a Card, etc.
- Tool: BBVA Continental ATMs.
- Goal: Directly the realization of a payment and Updating his personal information, both by the ATM.
- Result: Refers directly to success of every of two goals described before.

Other Relevant Aspects. Other relevant aspects about interfaces that were considered are elements of accessibility, culturalism and emotions.

- Accessibility: Prototype proposed can be used by tactile o physical (buttons). Every interaction with the screen generates a sound. Additionally, we considered type and size of letters. Those permit that users with certain disability can use the ATMs.
- Affordance visual: Keyboard icon permits that the user associates this image with the functionality, which is, deploy the tactile keyboard.
- Culturalism: According to García [12], images, symbols and objects used in interfaces do not carry the same meaning in different cultures. Therefore, for the interface success in an international market, the images must be selected and designed carefully. Then this concept is applied in the design of the interfaces requested.
- Emotions: Given the concept of emotional communication between the system and the user, it is approached from the point of view that a particular client can dispel his frustration due to failed operations with messages that help the individual to feel less guilty of the failure. The cases with very effective interfaces consider this subject. The absence of this concept is a major weakness in the interaction as it tends to focus on the rational user behavior, ignoring their emotional behavior [13]. For this reason, this point is considered as one of the key issues in this work.

Scenarios

Payment to Companies. This covers the payments that a customer can do to institutions and companies that have an agreement with the Bank. These payments will be able to do by ATM independently of ATM's model or mark. This functionality should be based in a screen flow similar to Payment of Telephone Services, and implementing the navigation like the Payment to companies of the Internet Banking (screens were given by the Bank).

- Navigation should be based in Services Payment (flow already known by the customer).
- Navigation should include sections shown in Internet Banking (because is the new functionality).
- It should as far as possible try to have similar flows in channels (in this case Internet Banking and ATM).

The design challenge is to make various proposals that seek to achieve the objectives, knowing the constraints of an interface like an ATM. In that sense, the proposals can zoom in or out of some goals, even stop fulfilling some of the requirements. It has this flexibility because the transaction is completely new in ATM. Finally, flows are constantly under review and refinement.

Updating of Personal Data. This covers the customer requirement of updating his personal data managed by Bank for communicating with him. Additionally, the authorization that enables to Bank to use this data for sending promotions, offers or other info that the Bank considers convenient. The channel in which customer can do this will be the ATM, independently of ATM's model or mark. The workflow of Updating of Personal Data was provided by BBVA to designers.

For both scenarios, we build Use Case Diagrams and Activity Diagrams in order to model the behavior and understand requisites.

4 Results of the User-Centered Design

As result of the process described, we proposed interfaces and sent to BBVA Continental Bank. Some of the screens proposed were the following (Figs. 3, 4 and 5):

Fig. 3 Payment to companies screen 3 (prototype)

Fig. 4 Payment to companies screen 6 (prototype)

Fig. 5 Updating of personal data screen 1 (prototype)

5 Usability Test

In order to test the usability of the prototypes proposed, there was made a Usability Test, from the systematic observation of users doing real tasks. These tests permitted verifying the existence of possible usability problems in interfaces, and finding possible solutions for the problems detected. The test was run in three steps: Planning, Execution and Analysis.

5.1 Planning

As prerequisite, we made a physical mockup with measures closer to reality, which had a LCD monitor, 4 buttons in each side and a numeric keypad, as real ATM.

After that, 8 participants were selected according to profiles identified.

Also, we prepared three documents: Data necessary for doing tasks, Test cases, with variants in tasks for every user, and a Post-test questionnaire (Fig. 6).

5.2 Execution

Tests were made on October 27th, 2015 in Vereda Torres, Popayán.

After welcoming the users and explaining what was going to be done, each one was given a format with the necessary data to perform the tasks and another with the three tasks that had to be performed. Users lined up to perform the tests one after the other, simulating also the row that are usually found at ATMs.

When each user finished the test, they filled out the post-test questionnaire, where they presented their experience with the ATM. In addition, while each user was doing his tasks with the ATM, it was noted the possible defects of the interface, not only the visible defects, but also those expressed by the users' facial and body movements. Figure 7 shows to a user working with the physical mockup of an ATM.

Fig. 6 Physical mockup of an ATM with prototypes proposed running

Fig. 7 User doing tasks

5.3 Analysis

From the obtained results, we can affirm that:

- 87.5% of the users were able to update their data (telephone, cellphone, email, address) according to the assigned task. In addition, this same percentage of users (87.5%) stated that the interfaces for updating data are clear. In the other hand, at the time of seeking the action, 25% of users consider that they did not easily find the option (button) to update their data.
- 75% of the users were able to make their payments using the ATM in a traditional way (with physical buttons). This figure coincides with the percentage of users who consider that the interfaces to perform payments were clear (75%). Similarly, 75% of users say that they quickly found the option to do them. In the other hand, 62.5%

of users were able to make their payments using the touch interface and this same number considers that this option is easily found.

Then, from the feedback of users, we identified defects and grouped them into the categories presented below:

- Names of actions are not representative.
- Several actions on the same screen are ambiguous.
- Inaccurate language when giving orientation to the client.
- Important information should be highlighted.
- When requesting information, do so in the form of a question to the user.

These defects identified were corrected in a new version of the ATM interface prototype. Finally, prototypes improved were sent to BBVA Continental Bank.

6 Conclusions and Future Work

At the end of this process, we can conclude that prototypes delivered permit the user more freedom and use of the system with better satisfaction.

Also, we conclude that is necessary to follow an interaction design process, in order to ensure a design centered in the real needs of user. This will permit that they can do the tasks they need in an effective and pleasant way, reducing the mistake probability.

Given the results obtained from the usability test, we can affirm that the majority of the customers did the tasks without major difficulty. Then, interfaces delivered are adequate for implementing in BBVA Continental ATMs, because of the process followed and the users' acceptance.

According to the previous points, we affirm objectives given by the Bank were fulfilled.

Finally, we recommend to BBVA Continental Bank implement a systematic process of interaction design based on the techniques described in this work.

Acknowledgment. The authors thank to all the participants involved into the experience required to perform the presented study. The study was highly supported by BBVA Continental Bank, "Universidad del Cauca" and IDIS.

References

1. Granollers, T., Collazos, C., González, M.: The state of HCI in Ibero-American countries. J. Univ. Comput. Sci. **14**(16), 2599–2613 (2008)
2. Cooharojananone, N., Taohai, K., Phimoltares, S.: A new design of ATM interface for banking services in Thailand. In: Proceeding of the 10th Annual International Symposium on Applications and the Internet, July 2010, pp 312–315 (2010)
3. Rosenbaum, S.: Creating usable self-service interactions. In: 2010 IEEE International Professional Communication Conference (IPCC), pp. 344–349 (2010)

4. Van der Geest, T., Ramey, J., Rosenbaum, S., Van Velsen, L.: Introduction to the special section: designing a better user experience for self-service systems. IEEE Trans. Prof. Commun. **56**(2), 92–96 (2013)
5. Peres, R., Cardoso, E., Jeske, J., Da Cuhna, I.: Usability in ATMs. In: Proceedings of the 2011 IEEE Systems and Information Engineering Design Symposium, University of Virginia, Charlottesville, Virginia (2011)
6. Moreno, L.: Perfiles de usuario. In: AWA, Marco metodológico específico en el dominio de la accesibilidad para el desarrollo de aplicaciones web. Universidad Carlos III de Madrid (2010). http://labda.inf.uc3m.es/awa/es/node/66. Accessed 21 Nov 2016
7. Garrido J: Ingeniería Semiótica: Recuperando la Simpleza de la Comunicación. In: Faz: Revista de diseño de interacción (2014). http://www.revistafaz.org/n6/faz6_01_ingenieria_semiotica.pdf. Accessed 21 Nov 2016
8. Carvalho, M., Bellotti, F., Berta, R., et al.: An activity theory-based model for serious games analysis and conceptual design. Comput. Educ. **87**(C), 166–181 (2015)
9. Barros, B., Vélez, J., Verdejo, F.: Aplicaciones de la teoría de la actividad en el desarrollo de sistemas colaborativos de enseñanza y aprendizaje. Experiencias y resultados. Inteligencia Artif. Rev. Iberoamericana de Inteligencia Artif. **8**(24), 67–76 (2004)
10. Holzinger, A.: Usability engineering methods for software developers. Commun. ACM **48** (1), 71–74 (2005)
11. Paz, F., Villanueva, D., Rusu, C., et al.: Experimental evaluation of usability heuristics. In: Proceedings of the 2013 10th International Conference on Information Technology: New Generations, 2013, pp. 119–126 (2013)
12. García L: La cultura en el Diseño Centrado en el Usuario. In: Revista UX Nights (2015). http://revista.uxnights.com/la-cultura-en-el-diseno-centrado-en-el-usuario/. Accessed 21 Nov 2016
13. Hassan, Y., Martín, F.: Más allá de la Usabilidad: Interfaces 'afectivas'. In: No Solo Usabilidad (2003). http://www.nosolousabilidad.com/articulos/interfaces_afectivas.htm. Accessed 21 Nov 2016