

Gestalt Prototyping Framework applied to design a Mobile-Commerce interface

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Abstract—This article presents the different concepts that were considered to design the interface of an e-commerce platform and its consequent adaptation to a mobile environment. The parameters considered during the development of the high and low fidelity prototypes are the result of an association between usability heuristics, Gestalt principles, and specific user experience (UX) interactions. This project shows the results of the projections of the usability tests carried out on the functional application, in which it was possible to understand the close relationship between the use of usability concepts that intervene in the functional actions of the application with the perception of aesthetics.

Keywords—usability, user experience, heuristics, gestalt, mobile, interfaces.

I. INTRODUCTION

The Gestalt Prototyping Framework [1] links Nielsen's Usability Heuristics [2] with the Gestalt perception principles, defining characteristics of the graphic components of the interface of a mobile device so that the heuristics have a level of interpretation and visual references. The postulates of the Framework indicate that the appearance and behavior of the visual components of the interfaces have an impact on specific interactions of the user experience and the level of perception of aesthetics of a mobile application.

These resources guide the development of prototypes of mobile device interfaces and allow designers, programmers, and usability experts to anticipate errors that could appear in usability tests in their projects. Previous articles have described improvements in prototype evaluations [3], which are associated with the application of these methods and tools.

II. BACKGROUND

A. E-Commerce in emerging markets

The restrictions on mobility, caused by the COVID-19 pandemic, the markets related to Retail in E-Commerce expect a growth of 30% in emerging markets of Latin America; several countries reduced face-to-face sales and began to operate in digital transactions. In Ecuador, the monthly frequency of online purchases went from 19 to 40% during the first year of the pandemic. During this time, the increase in users of digital platforms grew by 54% [4].

B. E-Commerce platforms and applications

At the present day there are different technological alternatives to implement an E-Commerce platform or services for a business [5], some of these solutions can be directly integrated from social networks or open access platforms [6]; however, several brands or businesses prefer to carry out their implementations and solutions

C. Designing the Interfaces for an E-Commerce

In this type of project, regardless of the development methodology used, one of the main challenges is that the functional aspects of the application are compatible between the desktop and mobile environments [7]. Not only the visual aspect must be similar, but the responsive adaptations must maintain consistency between different devices so users may have it easier to learn, reserve, or purchase products in all possible environments of the same virtual store.

In this context, the interface for the mobile device presents challenges that must be addressed and answered from the prototype phase, since not all the functions that will be available on the computer can be effectively included in a smartphone [8]. Several articles describe the differences at the operational level between a desktop application and a mobile application. Therefore, some of the problems when approaching these projects are underestimating the functions or characteristics of the devices, delegating the interface to the responsive options of the browsers, and finally considering that the results of the user experience tests are transportable or projectable between devices.

According to Zaifulusraf Ahmad [9], M-commerce (Mobile-Commerce) requires special attention from the development team; In his work, he points out that six emotions must be generated in a consumer to guarantee that the application has a high value; these emotions are glamor, dynamic, comfortable, passion, unique and cool.

This is a derivative work by Gong & Tarasewich [10] that uses Shneiderman's "Golden Rules of Interface Design" [11] to provide eight recommendations on interface design, such as avoiding scrolling, using flat interactions, designing a consistent navigation system, facilitate the use of a "black button", provide stories, avoid product recall and limit search possibilities.

Both the emotions defined by Zaifulusraf and Gong's recommendations, somehow underlie the usability heuristics; All these concepts can lead to the abstract and do not offer concrete references to develop prototypes [12], which can mislead the development team and obtain inconclusive results in user experience tests, in addition, they do not offer mechanisms to approximate effectively to the user's perspective.

III. M-COMMERCE INTERFACE DESIGN

A team of teachers and students from the Indoamérica University of Ecuador developed the Invirtual Shop application, a retail portal that offers products in four market lines, beauty, home, health, and fashion. This project was produced using agile methodologies, low and high-fidelity prototypes.

The development team used GEPROF-EMAT, an automated inspection UX measurement tool, which uses questions about specific interface components. Using Likert scales, it determines projections on compliance with usability heuristics and offers suggestions to improve the visual appearance and interfaces. The usability experts who worked on the application used those suggestions to make adjustments to the prototypes.

The Gestalt prototyping framework defines some recommendations on the visual aspect and behavior of the different components of a mobile interface, which have an impact on specific user experience interactions, which in turn are related to Usability Heuristics. The Framework provides references to identify the components of an interface that affect a heuristic and that generate negative results in prototype tests.

In the case of M-Commerce, several of these concepts are applied not only to the interface but also to how functional aspects of the application are conducted, such as the presentation and arrangement of products, processing of requirements, temporary listings, gateway payment, and management of customer information.

In the Heuristic Match Between the System and the real world, visual components such as the use of iconography and fonts are defined. Recognition better than recall defines the visual components of the menus, the behavior of the information blocks.

The aesthetic and minimalistic design facilitates the management of information in the product display sequence, content layout, menu components. Visibility of System Status defines how the closing of a sale is processed, the provision of information about the user, the alert system and regulates the amount of information required by the system for operations.

A. The main menu

For the menu of the mobile application, the Gestalt principles of simplicity are used, which indicates that simple shapes are easier to perceive and recognize, this facilitates learnability interactions and the relationship of the application with the real world. The principle of the proximity of similar shapes causes the buttons to be associated as a group and complementary functions can be defined.

For this reason, the icons are of the same color and are grouped according to the levels and sublevels of functions. Figure 1 shows the distribution of the main menu, it can be seen that group A presents functions related to information and user profile, group C presents functions related to the acquisition and display of products, while group C presents functions that allow you to explore the main product categories.

The main menu of the mobile application is developed in 2 levels of functions, while the desktop version has up to 4 levels, the different tests with prototypes facilitated a prioritization of the functional aspect.

With the reduction of components and visual details, the standardization of the iconography, in addition to the grouping of buttons and functions in a natural way, a minimalist design can be obtained, at the same time that consistency and efficiency are facilitated.



Fig. 1. The main menu of the application

B. Interface Layout

The interface of the mobile application is presented to the user in 4 perfectly identifiable zones that remain, hide or move in a programmed way according to their functions. According to Figure 1, within the interface the content is distributed as follows: Sector A presents the main menu that remains fixed, Sector B presents a product slider, the different user experience tests determined that in this section is necessary to maintain only essential information such as product name and price should be presented, as well as pop-up information that indicates whether a product is on sale or out of stock.

In the mobile version of the virtual store, the images of the products do not have animations, nor do they have effects such as shadows, reflections, or flashes. Sector C was planned as a “rest area” where large images, offers, or decorations are presented, which is designed to reduce the user's cognitive load, and finally Sector D, which is reserved for the buttons of the device's operating system.

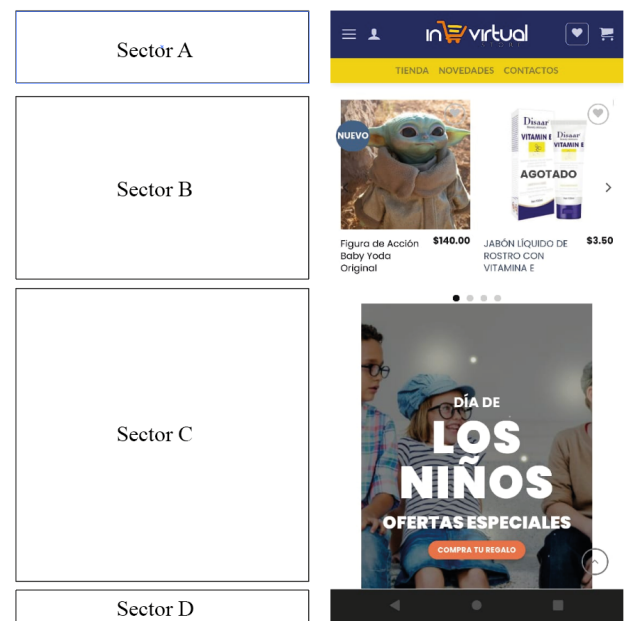


Fig. 2. Product interface layout

As the user decides to scroll down, the application repeats the sectors with new content variants; this is due to the use of the Common Direction principle of Gestalt, which states that objects that move towards the same point or have a similar behavior are perceived as part of a group.

Regardless of the location of the sectors, if they carry out similar movements, the user will perceive them as the same category or will have the idea that they fulfill the same function although the products and content are different. This content handling facilitates the visibility of the System Status and increases the Learnability and memorability capabilities of the application.

C. Other components

The dynamics of an M-Commerce requires that the application store and present information regarding the user's account. Figure 3 shows the layout of the interface that can be accessed through a sliding menu, subsection A presents the application's search engine, subsection B has access to the customer's account information, Subsection C can slide to show or hide the drop-down menu, and finally, there is the output area that represents 40% of the interface.

The Aesthetic and minimalistic design heuristic simplifies the graphic elements, compared to the desktop version, the mobile application menu eliminates details such as iconography that could saturate the reduced space of the interface, background color are used as part of the Similarity Gestalt principle to separate subsections and group buttons naturally generating categories.

This same principle works in the Recognition rather than recall heuristic to focus the user's attention on the side menu while keeping a reference to where it was before deploying it.

This handling of the interface has a direct impact on interactions such as ease of use and efficiency, as it facilitates the customer to perform mechanical actions, reducing the cognitive load and the interface learning process.

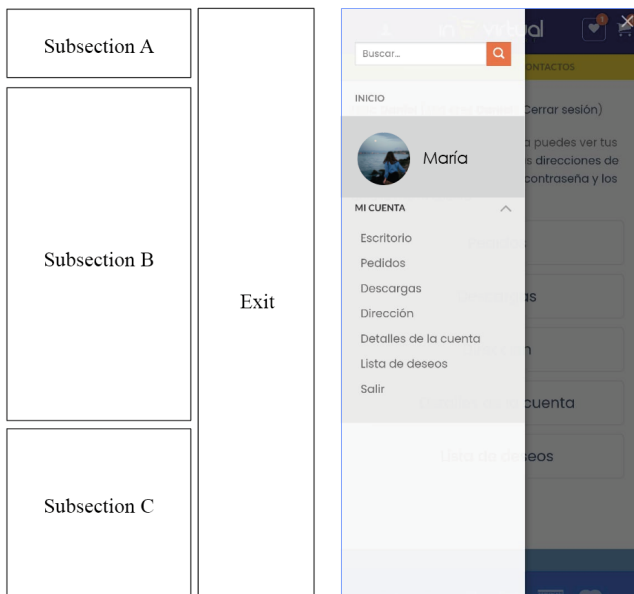


Fig. 3. The layout of the side menu

In the payment gateway, it has been possible to recognize the presence of Gestalt principles such as Simplicity in the payment gateway, since the abstraction of the forms, the reduction of graphics and prioritization of content, help Heuristics such as Recognition rather than recall and Visibility of System Status can be recognized.

Figure 4 shows the handling of the 6 components that make up the purchase completion sequence that in the mobile

App only one window is made, while in the web version it is done in two interfaces. This reduction in components was achieved through corrections made during testing of the high-fidelity prototype, as it reduces the risk of the customer abandoning the purchase. Considering the importance of this section, the Gestalt principle of Similarity was used, which indicates that in addition to grouping similar objects, alterations of the patterns can be used so that anomalies can be detected.

This foundation means that by using a different background color, attention can be directed to a specific component of the interface, facilitating its recognition. In this case, emphasis is placed on the total amount of the purchase and the shipping values or subtotals are downplayed so that the customer can reduce the time it takes to make a decision.

This structure of color blocks allows the customer to perceive and differentiate more easily the functions to select and without further explanation of the application can perform the same operation without having to memorize the interface components.

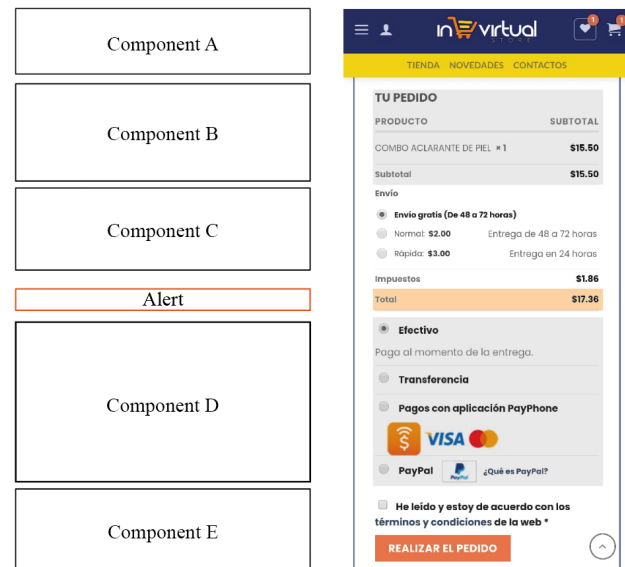


Fig. 4. The layout of the payment gateway

IV. RESULTS

Using the evaluative model of the Gestalt Framework and the GEPROF tool that projects usability measurements using inspection methods, a specialist performs the verification of 20 visual components of the application using an automated questionnaire and LIKERT scales [13].

In total, 3 checks were carried out with different evaluators, in the production stages of low-fidelity prototypes, high-fidelity prototypes on Adobe XD [14] and, the functional application. Next, we present the results of the latest projection carried out on the application in its Beta version already available to the public.

Table 1 shows the results, around the Gestalt principles recognized in the interface. It was possible to identify that the principle most present in the application is the principle of proximity.

TABLE I. GESTALT PRINCIPLES FOUND IN THE INTERFACE

Gestalt Principles Recognized and Applied				
Evaluated Items	Similarity	Simplicity	Proximity	Common direction
Iconography Buttons Menu	60%	66.7%	73.3%	46.7%

Table 2 shows the percentage of compliance with the usability heuristics that are related to the functionality of the application and that can be identified from the graphical components.

TABLE II. USABILITY HEURISTICS FOUND IN THE INTERFACE

Heuristics recognized in functional aspects				
Evaluated Items	Match between system and the real world	Recognition rather than recall	Aesthetic and minimalistic design	Visibility of System Status
Iconography Buttons Menu	60%	93.3%	26.7%	82%

Table 3 shows the projection in the usability interactions that have been identified in the application from the graphic components of the interface, a projection of perception of aesthetics is also included.

TABLE III. USABILITY TEST PROJECTION

Projected Interactions				
Learnability	Efficiency	Memorability	Easy of use	Consistency
60%	93.3%	26.7%	82%	66.7%
Projected Aesthetic perception: 66.7				

V. CONCLUSIONS AND FUTURE WORK

The development team considers that the projection results of the user experience test are consistent at first glance with the data that could be obtained in the usability test with real users; It is important to consider that the GEMAT Tool and the same evaluative model of the Gestalt Prototyping Framework are still in the calibration phase and that the algorithm that calculates the margin of error is still under evaluation. In any case, the results presented in this study are consistent and reaffirm the existence of a cause-effect relationship between the use of Gestalt principles and compliance with the usability heuristics parameters.

In the same way, the data found in the projections point out that there is a directly proportional relationship between the results of the usability interactions and the perception of aesthetics that a user could have regarding an application; Consequently, it would not be hasty to infer that a correct application in the functional sphere can also be perceived as aesthetic, although this assessment is referential and abstract. We may never be able to assess the aesthetics of an application from a strict point of view, however, the concepts applied to the design of the interfaces described in this study open up the possibility that soon we may have at least references that put a development project on the right track.

In the near future, the authors of this work will concentrate our efforts on contrasting the user experience tests carried out on real people, with the results obtained through automated inspection tests. We are clear that the human factor and the experience of a usability evaluator are irreplaceable, however, the use of automated tools could reduce the time in the execution of a project, especially in the prototype development phases.

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