Accepted for publication in IAMOT – International association for Management of Technology (May 2003)

Efficacy and Transparent Communication in Usability Oriented Systems

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Abstract

Information is the blood of modern organizations. It permeates the organization in several distinctive ways, and more and more, it is a key factor not only in terms of competitiveness but also in terms of public perception. The Internet revolution has made all organizations aware that their information is not only important for internal but also for external consumption.

Information system processes and distributes the information. They are designed with the purpose of establishing a productive interaction between the system and their users in order to increase people's productivity while performing their tasks.

Due to the great value of information, the user interface becomes an important part of information systems. It is the visible part of the system and where the dialogue between man and machine is established. It is necessary to design user-friendly interfaces, that is, easy to use interfaces. To be friendly, an interface must suit each user's need and satisfy his/her expectations.

To obtain such systems´ interfaces, the designers must take in consideration the non functional requirement (NFR) usability at the system definition. These requirements, related to data input and to the display of information, assure that the information given is complete, correct and not ambiguous, allowing the designer to use facilities that improve the system's efficacy.

In this article we define the non-functional usability requirements show how the lack of consideration them interferes on the quality of a product. To exemplify, we analyze how some examples are used in a famous Brazilian commercial site (www.pontofrio.com.br).

Key words: usability, non-functional requirement, user interface, site

1. Introduction

Information is essential to any organization success and efficacy. All organizations involve people working and cooperating together. As such, it is important that the

information flows, properly, through all parts of the organization. Because of this crucial role of information, organizations spend part of their budget with information systems, and they need quality information.

Information systems are designed with the purpose of establishing a productive interaction between the system and their users in order to increase people's productivity while performing their tasks.

The dialogue between man and machine is established by means of the user interface, the visible part of the system. Because of that, the interface becomes an important part of information systems

Assuring that systems are developed in such a way that the interface with its users are taken care is only possible if there is a way of guaranteeing that the NFR usability is taken in consideration at the system definition (Bias, 1994).

Usability is defined by a product being easy and fast to learn, efficient to use, easy to remember, cause no operating errors and offer a high degree of satisfaction to the user, and solving the task it is designed for.

Failure to take NFRs in consideration has been reported in the literature (Breitman et al, 1999) (Davis, 1993), (Cysneiros and Leite, 1999). In this article we show how the lack of consideration of the NFR usability interferes on the overall quality of a given product.

NFR Usability

The communication between users and an Information System (IS) is established by means of the IS interface. A good IS design must guarantee a transparent communication, that is, it must assure that when a user access the IS to perform any task, he only needs to focus his energy on the work he wants to do (Norman, 1986).

To have users focusing their attention mainly on their tasks, the process of software development must be "user centered", that is, its interface must be designed with the objective of satisfying the expectations and needs of users. The design of an interface that considers users' characteristics and the NFR usability is a difficult process for many reasons, but most of this difficulty can be traced to the lack of attention on NFRs during the system definition process.

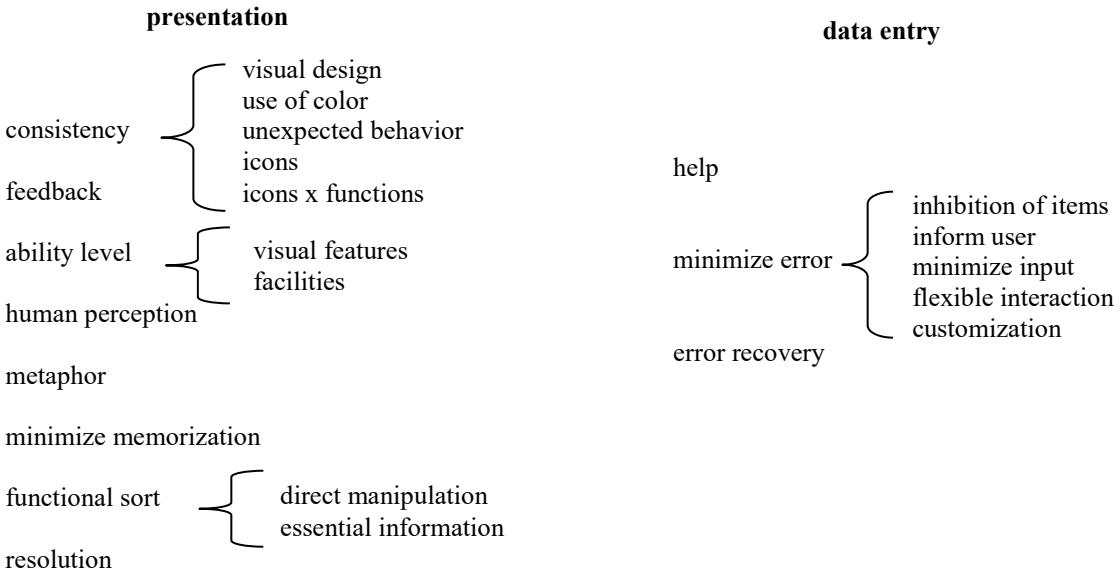

Figure 1: Usability Taxonomy

Different from the approach taken by Cysneiros (Cysneiros and Leite, 1999) to show the impact of not considering NFR during system definition, we decided to perform a post analysis of an information system available on the Web. Our approach is a qualitative one, that is we use the taxonomy to analyze the interface of an information system pointing out the problems that an organization may find when the NFR usability is not taken in consideration.

We decided to choose a well know Brazilian web site, *PontoFrio.com* (www.pontofrio.com.br), in order to perform our analysis. Your results are presented with the sole intention of showing how important is to consider NFR as early as possible during the process of system construction. We follow the taxonomy to describe the results of our analysis.

Presentation Category

Consistency

Consistency is one of the main features for the usability of an interface. It helps to avoid the frustration induced when a system does not behave in an understandable and logical way. Moreover, allows a person to generalizes the knowledge about one aspect of the system to other aspects (Foley, 1990). To be consistent, menus, commands, information exhibitions, and all the functions of an interface must have the same visual presentation.

Several screens of the site *PontoFrio.com* present inconsistencies in several of its aspects.

Visual Design

The screens have different layouts. Some pages have an horizontal bar relating the visited pages and others don't. This may frustrate the users. He may expect this bar all over the site.

The site's main page presents a first level vertical menu, "*Departamentos",* above the upper blue bar. This menu is exhibited in the other site's pages, as a second level menu, only when the user clicks on it.

The site has a horizontal menu on blue bar. This menu has items that are links to other pages. Once the user chooses one of these items, he/her goes to the respective page.

The pages opened when the options "*Parceiros"* or *"0800 90 18 55"* are selected have layouts (design, font type, color, size among other features) completely different from all other pages.

Another problem is the *list box* beneath the departments. The list box presented in the main page show some departments not listed on other pages. If the user is not in the main page, he may not realize the existence of these departments not listed and consequently not buy their products. This may cause a serious problem for the business: the user may move to another site believing that what he wants to buy is not offered.

Proper Use of Color

The color, basic element in any communication 's process, may interfere with emotions and cognition process of a person (Marcus. 1987); it can deliberately be used to reach specific objectives. The combination of colors must be carefully chosen (Jackson ET AL, 1994), (Marcus, 1987) and (Ferreira et al, 1999). The appropriate use of colors may help to produce a quick and correct assimilation of the information. Its inappropriate use may turn the information incomplete, ambiguous or intelligible for the user. Its impact in the effectiveness of the interface depends on the relevance of its use for the performance on a task and on the situation and environment where the task takes place (Smith, 1987).

The interface designer of the site *PontoFrio.com* was not careful choosing the colors. We can see that color was not used with the purpose of improving communication. Basically all pages are white and blue. Different colors could be used to help users identify different items, that is, each page related to one item could have been designed with different colors.

People associate colors the diverse situations of its lives. These associations depend on diverse aspects: geographic, cultural, age. Based in this property, colors can be used to help users to navigate among a site. The site *PontoFrio.com* was designed without considering these associations.

Unexpected Behaviors

Another serious problem on the analyzed site is unexpected behaviors caused by bad design.

Some items of the horizontal menu present a pull down menu with additional options and others no. Items without pull down menu should have them, because they

also have some additional options that users might want to choose; this may cause a frustration on the user, because when he navigates through the site, he probably is expecting for those menus.

Once the item "*Procura",* is selected, no page is opened, only an *edit box* is shown. Even though this box is designed to allow users to write the name of a product and find it, it is impossible to the user to write the name on it. This edit box does not work properly.

Uses of different icons or items´ names for the same action

Another serious problem is the different icons or items´ names for one same action, like the action of finishing the shopping. On the upper part of the site there is an icon with the words "*concluir compra*" beside. This same action can also be done when the user chooses the option "*fechamento*" on the orange horizontal menu. Another detail is that the icon related to this action sometimes has one appearance and other a different one. These inconsistencies may disturb the user

Feedback

In any form of communication, feedback is very important. When two people talk, they are constantly giving each other feedback through gestures, expressions and others. In order to obtain a good interaction of a person with a computer, good feedback must be supplied, however in this in case, they must be planned and be programmed (Foley, 1990). The site studied has some good examples of feedback.

One the best feedback is showed in the upper right part of all pages: the indication of the number of products already added by the user to the shopping cart and the total amount he will have to pay.

However there are some problems related to the feedback. When a client wants to register he must fill several fields; at certain moment, the site presents to him small green squares beside some files. The user must *guess* that the filling of these fields is mandatory, but there is no indication of that. And the worst, all other sites use red asterisks to indicate this.

Different Ability's Level and Human Behavior

Since an interface must be designed in such a way that it can be used by experienced users and by beginners, it must have some peculiarities.

Use of Visual Features

Visual features, such as pictures and icons, are excellent tools for beginners; they help them to visualize its actions better.

An icon is a pictorial representation of a function, an object, an action, a property or any other concept. Well designed icons can be recognized faster than words; if well chosen, they become independent of language, making possible the use of the interface in several countries without being necessary any translation. *PontoFrio.com* pages use very few icons to assist the users and sometimes it does not use them in a proper way and many of them are not well designed. One of the few icons used is the popular *shopping cart* but omit others often used like *question mark* representing the help function.

Well-designed icons have the following characteristics:

Easy Recognition: how long it takes to a user to find out their meaning.
Easy to remember: how long it takes to a user to recall it's meaning once he had already forgotten.
Easy to discriminate: how easy is to a user to discriminate the icon among other icons.

The few icons used are not easily to be recognized, remembered nor discriminated.

Use of Other Facilities

Some Features like menus, forms and prompts are of great aid to the beginners and are present along the entire site. Since many times advanced users consider these facilities slow, well projected interfaces must also allow the use of *accelerators* such as *function keys and textual commands*, in order to make the interaction faster (Foley, 1990). *PontoFrio.com* allows the user to navigate using the keyboard.

Human Perception

The perception of each person depends on hers abilities to perceive and to treat information. Variations of physical abilities, behavior and personality influence the success of a system. Each user possesses a cognitive style that determines how he perceives the information. To create an interface that in fact can be used by different people, it must be possible to display its content in different forms in order to accommodate the different perceptions (Press, 1992). Despite the trend if using graphical elements in the web sites design, much information continue to be give in the literal form. Reading constitutes an essential activity in many systems. The text size, the font source, upper/lower case, the location and color are factors that directly affect the easiness with which the information is perceived, that is, its usability.

PontoFrio.com has few customization possibilities. It is not possible to change its text size, not even using the browser. This can prejudice people perception, especially older people that need bigger fonts to read.

Metaphors

The designer must take advantage of people's knowledge of the world around them by using metaphors to convey concepts and features of the site; the use of metaphors that involve familiar turns the interaction less hostile and easier (Apple, 1992).

One of the best example metaphors used in commercial sites is the shopping cart, used in *PontoFrio.com*. But sometimes, instead of showing a picture, it uses just words to represent the cart.

PontoFrio.com´s site presents some metaphor not properly used.

To recalculate the amount of money on a shopping is used the plus signal inside a circle. The signal plus is a metaphor of the action *add,* and this picture is also *used to the action of add a new product to the cart.* The representation of the *recalculate* action would be better done if a picture of a calculator machine were used.

The action of *finishing a shopping* is represented by a *check mark*, symbol of *OK* bottom*.* This may confuse users.

With the Ok bottom example we can conclude that is not a good idea to modify the meaning of items already standardized. It must be used consistent labels, standardized abbreviations and predicable colors. New representations must only be created if they have still not been standardized; in this in case that, arbitrary signs cannot represent them; they must be carefully chosen.

Minimize Memorization

A good interface invokes the user's recognition rather than recall memory whenever possible. *PontoFrio.com* sometimes forces unnecessary memorization. Few mnemonic names and not well-designed icons are often used. Since the signs (icons, command's names etc.) are the essential elements of a screen, they must be well produced. During development process, the designer must pay attention to the choice and design of the signs so that that they do not induce doubts (press, 1992). The analyzed site has many examples of of non-use of icons and use of icons that do not express its objectives.

Functional Command's Sort

The menu's bars offer options the user; they consist in a good way to access functions not constantly requested. They reduce the memory load for the users and their content depends on the site, but generally, the several pages of a site have similar bars, with their items arranged horizontal or vertically.

When a menu's item is chose, it can show a sub-menu below it (*pull-down menu* or *hierarchical menus*); in this in case, the names of the items are located one below another. One of the advantages of a pull-down menu is that it is called only when it is necessary, thus saving screen space, without polluting the screen and without offering a series of options that can confuse the user.

The word *menu* is a metaphor with the restaurants' menu. Normally, in a restaurant's menu, the options are grouped together according to the kind of food (sea fruits, meat, pasta … masses etc.). In the same way, in an interface's menu, the options must be grouped following some functional similarity criteria established by the designer.

When people need to deal with great amount of items, it is known that they feel more comfortable if the number of items is not greater than seven more or less two. Thus, a menu must not have more than seven more or less items. Some menus of the studied site have many more items than what is recommended. Probably the user would feel more comfortable if some items, like *Audio*, *Video*, *Livros & DVDs*, and others could be in such way that only the main options were showed. Many of these items could only be showed as pull-down menus, when the user passes the mouse over the main options.

Direct Manipulation

Direct manipulation makes people believe that they control the objects represented by the computer; an object on the screen must remain visible during while the user is performing any action on the object, in this way, the impact of the operation on the object may be immediately perceived by the user. The same way, when the mouse passes over any object that may be manipulated, this must be highlighted. The analyzed site does not highlight the items. When the mouse passes over them, they remain with the same visual appearance. The user will onle notice that they are been chosen if the respective item have a have pull down menu associated with it.

Exibit only the information that is essential to the context

In order to be better assimilated, only the information relevant to the current context or mode must be shown; the user must not have that to be looking for among many data what he needs to execute its task.

PontoFrio.com's interfaces are poor when dealing with information. The several site's screens many times are full of information, text, pictures, … that turns the process of finding something very difficult and boring for the user.

To improve the information quality, it must be used, always that possible, distinct windows to show information of different types and, at least one part of each window must be visible (Press, 1992).

The only moment that a new page is open is when the user chooses to see his shopping cart ("*Seu Carrinho"*). In the rest of the site, different types of information are showed in the same window. Not even the part related to the site partners, called "*Parceiros",* are showed separately. This part in fact could be considered apart from the rest of the site, and their content could be shown in different windows.

Resolution-Independent Design

Another issue that must be considered when designing usability-oriented sites is the resolution-independent design. In traditional interfaces, the designer knows for which environment he is designing; he has total control on each pixel of the screen that appears for the user, and he can be sure how each element will be seen in the screens, independent of the resolution of its monitor.

In Web, the designer has no control on the layout of the interfaces. Once the user can access the Internet in many ways, design for web must adequately be planned. One of the basic principles of constructing resolution-independent sites is instead of using fixed sizes to design elements of the interface; one must specify layouts as percentages of the available space (Nielsen, 2000). This really must be considered once many people and organizations still have low-resolution's monitors

PontoFrio.com's site design is not resolution-independent. When this site is displayed in a low-resolution monitor, important elements disappear (the upper icons…) in these monitors the user now has to use the horizontal scroll bars to see the whole pages.

Data Entry Category

Users spend a lot of time choosing commands, typing data and others inputs. A good interface must minimize the time that the user spends with these tasks. The following guidelines improves the interface's usability when dealing data entry (Press, 1992):

Help Facilities

Help must be supplied for every input action. Even thought there exists a Customer service page, "*Ajuda*", where the users can find detailed information about many of the site's features, it does not offer tips when a user passes the mouse over the screen's element (tips are showed only over the upper icons). These facilities should have been implemented; they allow the user to find out the utility of many items without going to the customer service.

Minimize Error Possibilities

One of the objectives of a good interface is to prevent that its users commit errors. Well designed interfaces must provide prevention error mechanisms that guide the users to work within any context and make it difficult for the user to do things that are not permissible in that context. Therefore, the user will not choose an invalid option and afterwards receive an error message (Foley, 1990). The site presents some of these mechanisms:

Inhibition of Items not Valid

Items not valid in the current context should be inhibited or disabled. When the shopping cart of a user is empty, the site does not disable this invalid item but it alerts him by showing the message "*your cart is empty'*. In fact, the site allows the user to choose the cart icon and only then it alerts the user through a message. It would be better if it also changed the icon's appearance (for instance, changing its color), so the user would not even think about clicking the cart icon.

Inform How the User Must Input Data Correctly

The user must be informed of how he must fill any field. *PontoFrio.com* guides the user in this task: whenever the minimum or maximum length of characters is limited, at least one number is required, these information is given to the user before he fills the field. An example can be seen in the message showed to the user when he is registering himself.

Minimize the amount of input

A good interface minimizes the number of actions necessary for any input, reducing the task of typing. *PontoFrio.com* does not provide such facility, for instance, when the user is becoming a registered customer, he needs to fill the date of his birth. The site does not automatically put a slash separating the day, month and year. Instead, the user must type it.

Flexible Interaction

A well designed interface must allow the users to control the interactions; he must be able to skip unnecessary actions, to modify the order of the actions and recover errors without leaving the site. He must also be able to interact with the site using the mouse or the keyboard. *PontoFrio.com* allows the user to navigate through it without a mouse.

Customization

A good interface must allow that to the user customize its commands and messages. *PontoFrio.com* does not allow customizations, not even in the text size.

Provide Error Recovery

Experimental evidences show that people are more productive if their mistakes can be readily corrected (Foley, 1990). So a well-designed site must provide a good error recovery (*undo, cancel, correct* …). By providing this error recovery, the user feels more comfortable to explore unlearned facilities without fear of failure. This encourages exploratory learning. Basically there are two types of errors: functional and syntactic.

1. Syntactic errors: occur when commands are typed with wrong parameters or names; in this case, the site must provide a clear message.

2. Functional errors: are the most serious; it occurs the user does a command he didn't mean and unexpected results occur. There is lack of error recovery facilities on the studied site. An example is the absence of the *cancel option,* on the cart shopping screen; it is not possible to just cancel a shop. To do this, the user must write the number zero on each product and then choose the option *recalculate*, spending a lot of time in this simple action.

Conclusion

We have argued about the importance of the NFR usability in the overall quality of information systems. We presented an usability taxonomy and used it to analyze one of the major Brazilian e-commerce initiatives.

The result of our analysis shows several aspects that could be improved in this specific e-commerce information system. However, our point is that these NFR issues, present in the taxonomy, must be dealt with during the definition phase of the information system and not afterwards.

Applying our process, which re-uses well established heuristics from the HCI literature, early on should lead to higher quality information systems. In a competitive market, the NFR usability for e-commerce applications will be of fundamental importance to the success of an enterprise.

We see our contribution as stressing the importance of the NFR usability as well as providing a list of characteristics that should be presented or avoided when building interaction in e-commerce applications. We also believe that our work is on the direction of building a corpus of knowledge about NFR and to represent that knowledge using the NFR framework (Chung et al, 2000). Once this knowledge is represented as NFR graphs we plan to pursue a conflict analysis of on the usability NFR graph.

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